A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIATRICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS, PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY, OTOLOGY, RHINOLOGY, LARYNGOLOGY, HYGIENE, AND OTHER TOPICS OF INTEREST TO STUDENTS AND PRACTITIONERS

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Diagnosis and Treatment

THE MANAGEMENT OF SUNSTROKE—A LESSON IN HYDROTHERAPY *

BY SIMON BARUCH, M.D.
NEW YORK

Of the synonyms of this disease—sunstroke, insolation, *coup de soleil,* asphyxia solaris, heat-stroke, thermic fever—I have chosen sunstroke, because the pure manifestations of the affection are rarely noted without the direct or indirect influence of the sun. The cases occurring in boiler-rooms, for example, are usually due to exhaustion arising from excessive muscular exercise in overheated and badly-ventilated places.

The disease appears to be most frequent in our own country, if we may judge from its rare mention in European, and its constant mention in American text-books. New York enjoys an unenviable reputation with regard to its prevalence, and especially its fatality. In Europe it is mentioned mostly in army reports, as occurring during marches. A recent statement gives the number of cases in the German Army from 1889 to 1900—eleven years—as 1520, with a mortality of 8 per cent. In the United States deaths from sunstroke are reported every summer by the health authorities, but the number varies enormously, according to the statistics, obtained through the courtesy of Dr. Guilfoyle, from 1895 to 1911, the lowest mortality having been 24, in 1902, and the highest 1229, in 1901.

The treatment of sunstroke is of especial interest to hydrotherapeutists as it is the only disease in which water is recognized by all authorities as the chief, indeed, the sole remedy. To a teacher of hydrotherapy the management of this affection now in vogue is of

* Lecture delivered on May 2, 1912, at the College of Physicians and Surgeons (Columbia University), New York.

absorbing interest, as it proves the hydrotherapy taught in our text-books to be faulty and exposes the incorrect conceptions of water as a remedial agent which have led the medical profession astray in the treatment of this and other diseases. It is only the most stern demand of duty to my colleagues and to suffering humanity that forces me to make what may be regarded as an extravagant and perhaps unwarranted criticism, but when I find the best text-books recommending ice-baths in the treatment of sunstroke, and this procedure resulting in a mortality of 38 per cent. or thereabouts, it is high time to protest. Reliable statistics, moreover, have shown that simple cold affusions—which were successfully used by Paulus Ægineta in the seventh century—were followed in one of our hospitals by only 6 per cent. mortality.

In order that we may reach a clear understanding of the therapeutic indications in any disease, it is necessary to ascertain the probable pathologic conditions underlying it. Disregard of this principle has been the unfortunate custom in the consideration of sunstroke in most of our text-books. The usual reasoning is as follows: Sunstroke is produced by excessive heat; its chief manifestation is high temperature, hence the proper treatment is to reduce the body temperature to normal; cold water is the most efficient antithermic agent in sunstroke, ergo, the coldest bath promises the most favorable results. This proposition involves several errors: (1) While excessive temperature is the chief manifestation, it is not the essence of the disease, and though its reduction is imperative, because hyperpyrexia imperils life, clinical observation demonstrates that many dangerous cases are not accompanied by extremely high temperature, precisely as we are taught by observation in typhoid fever. Moreover, if reduction of temperature were the only, or even the chief, therapeutic indication, the coal-tar preparations would offer the key to the situation. (2) Those who are familiar with the antithermic action of baths know that the most antithermic effect is not produced by the coldest bath, but by the hammock (continuous) bath at a neutral temperature, prolonged for an hour or more. I am not acquainted with any text-book on therapeutics or practice which mentions this important fact in hydrotherapy, and even the best works, books which have been translated into several foreign languages, and which on all other subjects offer perfectly safe counsel, reiterate in each new edition the

fallacious ideas on theory and practice in the treatment of sunstroke which have resulted in needless fatalities.

I shall demonstrate this statement by clinical proofs. So impressed am I with the solemn duty of correcting these mistaken methods that I have directed the attention of several authors to them, and, to their credit be it said, they have received the suggestion for the benefit of suffering humanity in the kindliest spirit. The following are excerpts from standard text-books on practice—their latest editions:

A. "The success of the treatment of thermic fever depends altogether on our ability to lower the temperature. For this end the patient should be placed in a bath of water to which ice is freely added to keep the temperature down as low as can be."

B. "Heatstroke, especially the hyperpyrexial forms, must be promptly treated by the application of the ice-bath (ice floating in a tub of water), temperature at 40° F., etc."

C. "In the severe febrile cases the first indication is to reduce temperature. The patient should be immediately placed in a bathtub containing ice-water and pieces of ice; he should be literally packed in ice."

D. "The treatment of sunstroke must be bold and vigorous; first the temperature must be reduced until it is at a safe level by the application of ice-water and ice, etc."

E. "In true sunstroke the treatment should be active and energetic, the indications being to reduce the temperature of the overheated centres. Hyperpyrexia must be combated by rubbing with ice, placing him in a tub of water with lumps of ice."

F. "In thermic fever the indication is to reduce the temperature as rapidly as possible. This may be done by a bath of 70° F. (duration not mentioned). At the Pennsylvania Hospital, in 1887, the ice-pack was used with great advantage. Of 31 cases, only 12 died, results probably as satisfactory as can be obtained." This excerpt is from the 7th edition of a book which has been translated into several languages by reason of its superiority as a text-book.

G. "In the hyperpyrexial form the vital indication is the reduction of temperature. The cold bath with ice floating in it and occasionally rubbing with ice is in my experience the best."

I propose to clearly demonstrate that a mortality of 38 per cent.

in sunstroke is absolutely indefensible, and to explain the reason for the fatality of a treatment which is reiterated in one form or another in every text-book. It is a trite physiological fact that when the animal body is exposed to a temperature higher than its own the sensory nerve-endings which form the temperature sense convey the irritation to the vasodilator centre in the medulla, and an increase of the large vascular area in the skin is produced in response to this excitation; according to the Dastre-Morat law of antagonism, dilatation of the cutaneous vascular area is accompanied by a corresponding narrowing of the splanchnic vessels; the blood which is becoming heated at the point of exposure (the skin) reaches the important visceral circulation but slowly, thus safeguarding important organs. At the same time heat is radiated from the skin and the latter is cooled by perspiration and its vaporization—the lungs assist by exhaling moisture.

These well-known processes are not, however, alone in operation. Rabbits exposed in a hot-air chamber at 42° C. (107.6° F.) for five hours show a diminution of fifty per cent. in the leucocytes of blood drawn from the ear. Twenty hours are required to restore them to a normal condition. There is not an absolute loss of leucocytes in this brief time, but by reason of the relaxed condition of the vessels of the periphery under the influence of heat these important cells are driven out of the general current, and thus are temporarily *hors de combat,* as was proved by Breitenstein, who has done in the Leipzig Clinic some excellent clinical and experimental work in hydrotherapy without being a hydrotherapist. He gives us a hint of what may have become of these blood-cells. Subjecting rabbits in a box to a temperature ranging from 95° F. to 113° F. for an hour, he found that the red cells diminished in the blood taken under all precautions from the lobe of the ear before and after removal from the box, and that the blood of the liver showed an increase of these corpuscles. It has also been demonstrated by Opitz in our own laboratory that the blood of dogs which were exposed to baths at 109.4° F. (42° C.) had its viscosity decidedly diminished. This change has also been noted by other experimenters in Germany.

Most cases of sunstroke arise in persons who are exposed to temperatures higher than those used in the experiments on the animals mentioned. During the epidemic of 1896, which in New York City

produced 648 deaths in one week, the average temperature in the sun was 119.3° F., and even in the shade it was 86.7° F., so that a workman who would be alternately in the sun and shade would have little, if any, relief from the deleterious action of this high temperature.

What are the clinical manifestations caused by the influence of high temperature? You have often had opportunity to observe patients in the hot-air boxes in the clinic; you have noted that by exposure to high temperatures the respiration is accelerated, the pulse is increased ten to thirty beats, the mouth temperature rises one to three degrees, and not rarely the patient feels faint despite the precautionary cold wet compress around his head. Judging from this group of manifestations arising from brief exposure, if the temperature were maintained for a long period, say of hours, it would produce positive cerebral anæmia, a reduction of blood-pressure, hyperpyrexia —in short, all the manifestations which are familiar in sunstroke. As a result of this depreciating influence of heat on the vasomotor system the eliminating functions of the organism are handicapped and the most energetic efforts must be put forth by the conservative agencies of the body to maintain the equilibrium by excretion. No wonder that they fail, and many persons succumb to the disease unless properly treated.

Experiments on medical students in Von Mering's Erlangen Clinic have demonstrated the enormous enhancement of metabolism under exposure to baths of 107° F. for thirty minutes. Even when the body temperature was not materially raised, there was an increase of 78 per cent. in oxygen consumption and of 91 per cent. in CO_2 excretion, which lasted with gradual diminution for over half an hour. It is therefore not an unwarranted assumption that this enormous enhancement of metabolism must be induced also in those who are exposed to high aërial temperatures for long periods, and that probably there is a retention of retrogade tissue change products as in fevers. The enfeeblement of the entire organism prevents the elimination of the latter, and in this manner doubtless may be accounted for those manifestations which have led some observers to class sunstroke among infectious diseases.

No matter what the theory of the action of high temperature may be, one point is absolutely clear—that we have to deal with a vaso-

motor depreciation with enfeeblement of the cutaneous vascular area. In other words, we have here the same conditions to deal with as in typhoid fever, with the difference only that here we stand in the presence of dangerous heart-failure in the inception of the case, whereas in typhoid fever this lethal condition occurs after the expiration of days of labor on the part of the heart to accommodate itself to the depreciated vasomotor action. This view affords us a key to the proper management of sunstroke, a management the correctness of which is established by the overwhelming superiority of hydriatic procedures directed to remedying the vasomotor failure over hydriatic measures directed to reducing temperature, as has long and fatally been the practice.

Sunstroke, like typhoid fever, affords a valuable lesson in hydrotherapy because it illustrates the vital importance of individualizing the temperature, duration, and technic of water procedures in accordance with the therapeutic indications—a matter long insisted upon by myself, but still not sufficiently appreciated. So long as the bath in typhoid fever was addressed to the reduction of temperature, the coldest bath was regarded as the most useful; the shock from such baths and consequent failure brought them into deserved disrepute. An example of the fatality of this treatment may be cited from Duschek's Klinik, where 60 cases of typhoid fever were laid in baths of 60° to 65° F. for ten minutes, whenever the temperature required reduction; no friction was used, the result being a mortality of 28 per cent. In Bellevue Hospital the mortality from typhoid fever under similar treatment was so great that the excellent clinician Dr. Austin Flint abandoned its use. The bath treatment was resumed by Dr. A. B. Ball with great success, when he practised the Brand bath, which involves active friction, and has for its chief object the restoration of vasomotor equilibrium, rather than a reduction of temperature.[1] I am now striving to restore the application of cold water to its rightful position as the most valuable agent in the management of sunstroke by exposing the fallacy of the reasoning referred to in my opening remarks. With this view I shall ask your close attention to some comments upon the most extensive and prac-

[1] "Principles and Practice of Hydrotherapy." By Simon Baruch, M.D. 3rd Edition, p. 172.

tical statistics on sunstroke management in the history of medicine. These were published in the *Medical News* of 1897, by Dr. Alexander Lambert, of Bellevue Hospital, an eminent clinician and teacher. I propose to illustrate the rationale of the action of various procedures reported and deduce from it some lessons for the rational application of water in this and other diseases.

There were 520 hyperpyrexia cases treated in the New York hospitals, with 132 deaths, all occurring during one week in August, 1895. The treatment in the four hospitals is detailed with unusual candor, despite the fact that it places the author's own hospital second highest in fatality. Here is a lesson in hydrotherapy which cannot fail to demonstrate the fatal negligence of this subject which characterizes the medical profession and the importance of instruction in hydrotherapy in our medical schools.

In one hospital in which the desire to reduce temperature seemed uppermost, tub baths were used beginning with water at 110° F., the body temperature being gradually reduced to 72° F. while the patient was lying in it; the number of cases was 49, with a fatality of 41.17 per cent.

Revert for a moment to what you have learned about the action of water above and below the skin temperature. Bearing in mind my hydrotherapeutic law that intensity of action is primarily in proportion to temperature difference between the skin and the water, we have here the skin a few degrees below the water temperature, consequently no vasomotor stimulation; the effect is neutralized, however, when the water temperature reaches that of the skin; here again comes the modifying action of gradual reduction which you have been taught. You may remember that while suddenness of application promotes vasomotor stimulation, gradual reduction accustoms the sensory terminals and thus neutralizes the stimulus. You could not choose a worse procedure than this graduated bath from 110° to 72° in any acute disease. Only once before in my experience have I encountered such a bath; it had been applied to a child suffering from severe scarlatina that I saw in consultation. I was powerless to save it. Let me warn you not to follow this example even in less serious cases. It is, unfortunately, a very common prac- of those who are apprehensive of shock from cold water, and who strive to avoid it, to order the patient to lie in warm water, open the

outlet and the cold-water faucet and thus obtain a gradually cooled bath. Many adopt this method in fever because they regard the patient as "too feeble to bear the shock." Some neurologists advise such procedures in neurasthenia, losing sight of the physiological fact that the so-called shock which they are endeavoring to avoid affords just the thermic stimulation they seek to obtain for refreshment of the depreciated neurons. Imagine yourselves using warm water gradually cooled for your morning ablutions; the refreshing effect would be *nil,* whereas a sudden dash of cold water to the face accompanied by friction gives new life and vigor without which the labors of the day would be irksome.

It may occur to you that after athletic exercises you have experienced the most invigorating effect from a gradually reduced shower bath, thus contradicting my explanation. But here we have quite a different condition. The individual is in perfect health, the heart acting vigorously and all the responsive agencies of the organism in the most active condition. Moreover, the water runs off quickly from the body; it does not continue to surround it as in the tub bath; there is invigorating stimulation also from the friction of the shower, and the entire procedure is brief. Here we have a maximum of refreshment with a minimum of shock, while in the warm tub bath gradually lowered we have (in sunstroke) at first the depreciating effect of warmth on the vasomotor system, in an already depreciated individual, and afterward the absence of thermic and mechanical excitation upon which all hydriatic procedures are based. Let me impress upon you the fact, derived from large experience and based upon physiological study, that the most effective stimulation is obtained from the sudden application of cold water, accompanied by friction. For instance, in typhoid fever you have learned that a bath of 85° F. for ten or fifteen minutes affects the febrile condition more favorably than a bath of 95° F. reduced gradually to 80° or 70° F.

Next in fatality in Dr. Lambert's report is the *ice-pack,* which is described as follows: "The ice-pack was given by placing the patient on a rubber sheet and packing large pieces of ice between the legs and alongside the body. The upper surface was rubbed with the hands and with pieces of ice. This procedure often required more than an hour. The temperature almost always fell." The distress a patient must suffer while shivering in this arctic environment is

obvious. No wonder it was fatal—38.7 per cent. mortality. What is the physiological action of such a procedure? Wherever the ice was in continuous contact with the skin the latter doubtless presented that wrinkled condition called goose-skin, which means that all its muscular fibres were contracted, with the result that the blood beneath was squeezed out of the cutaneous vascular area; the heart, already enfeebled by high temperature and its resultant vasomotor depreciation, must labor hard to overcome this resistance at the periphery, and, unaided by the normal elasticity of the cutaneous structures, it must succumb to the task. Despite the almost constant lowering of temperature, 38 per cent. perished. The only relief to the distressed organism was given "when the upper surface was rubbed." The lower extremities needed rubbing far more, for in these parts the circulation in health, and more decidedly in disease, is the most feeble. You doubtless remember that I have always cautioned you when possible to omit the extremities entirely when applying cold water.

The next most fatal result followed the application of the ice-bath. "By the ice-bath," writes Dr. Lambert, "is meant a tub bath in which ice, crushed into moderate sized pieces, is constantly kept floating. The temperature of the bath is about 40° F. Incessant and vigorous rubbing of every portion of the body is absolutely necessary. When the bath was given for ten minutes, irrespective of the height of temperature, the results were not good." No wonder that the mortality was 33.33 per cent. What is the reason? Let us hark back to our physiology again. When a greatly-depreciated individual with high temperature is immersed in water at 40° F. there is a temperature contrast of 65° F. between the skin and water; the first effect is a decided shock—an unpleasant surprise to the sensory terminals; there is a gasp, more or less embarrassed respiration, alarm if patient be conscious, and, if not conscious, a decided awakening to his surroundings. If the patient is removed at once, the effect is a positive vasomotor stimulation, as is noted when a stillborn infant is suddenly dipped in cold water, or when very cold water is dashed upon a person who has fainted. If, however, the patient is detained in this very cold medium for several minutes or longer, the primary stimulating effect is so intensified that it becomes depressing from overstimulation; the nervous system, already depreciated by the prostrating action of high aërial temperature, plus

muscular exhaustion, fails to respond to the overstimulus. Added to this is the contraction of the muscular tissues of the skin referred to already when the ice-pack was discussed. The muscular and elastic structures which abound in the skin act, as I have taught in the lecture on the anatomy and physiology of the skin, as substitutes in the capillaries for the muscular and elastic coats which control the calibre of arteries and arterioles. This contracted muscular stratum drives the blood out of the large network which ramifies in the papillary spaces, and the cold, being continuous and intense, constringes also the arterioles far more than any judicious hydrotherapist ever dares to advise or practise. The result is that the blood coursing towards the periphery fails to reach the large vascular area in the skin and superficial muscles in which abstraction of heat would be most active; the antithermic effect aimed at is absolutely defeated. Hence the large mortality incident to this procedure. It is not so fatal as the ice-pack because there is more opportunity for vigorous friction of the entire body, a procedure which stimulates the muscular and plastic structures and diminishes somewhat the chilling effect and cyanosis.

The next lowest mortality in these statistics was obtained by the more rational cold spray. The patient with an ice-cap on his head was placed on a rubber cot and sprinkled with water from the cold faucet from two sprinklers (the water was probably 70° F. or 75° F.). When the temperature fell to 103° F. he was wrapped in two blankets; if it rose to 104° or 105° he was again sprayed until the rectal temperature fell to 101° F. Among 26 patients with a temperature averaging 108° F. three died—11.5 per cent.

Why this marvellous difference between the ice-baths just discussed and the spray of ordinary water without ice? The physiological facts already stated furnish the answer. The application of water with friction, at a temperature thirty degrees below that of the skin, furnishes just enough thermic stimulation to arouse the vasomotor system without depressing shock. The latter is avoided by the evanescent exposure of the skin to the low temperature, and reaction is promoted by the friction with which the spray is delivered. Here we have thermic and mechanical excitation of the sensory terminals without reduction of temperature below the point of safety. This is the key to all cold-water procedures—individualization, recognizing

the responsive capacity of the organism to the degree and duration of each procedure. Another demonstration of this basic fact in hydrotherapy, which is unfortunately still too often overlooked, is furnished by the management of sunstroke in the St. Vincent Hospital, under direction of Dr. O'Dwyer, of intubation fame. Here "the patient was wrapped in a cotton sheet and placed on a rubber stretcher previously covered with a cotton sheet. Dipperfuls of cold water were forcibly dashed on him from a distance of several feet. In very severe cases, every two or three minutes a small stream of very cold water was allowed to fall six or eight feet upon the forehead. This treatment proved powerfully stimulative, and was continued until the temperature fell to 103° F. The patient was then wrapped in blankets and surrounded by hot bottles. Of 197 hyperpyrexia cases 6 per cent. died." If you consider this treatment in the light of the rationale of the action of water which you have been taught, you cannot find it difficult to explain why this procedure was successful in saving life. It is obvious that forcible dashing of cold water upon the skin covered with a sheet would produce at first the least abstraction of heat with the most thermic vasomotor stimulation. The patient, being wrapped in a sheet which is thoroughly saturated with cold water, enjoyed the advantage of a ready mode of abstracting heat *gradually* and of stopping the latter before it reached a dangerous point. Compare this practice with the ice-bath and you will not fail to realize why one was followed by a mortality of 33 per cent. and the other by a mortality of 6 per cent.

From a teacher, however, you may expect some positive data. I advise the following procedure in sunstroke: Prepare a cot, low bed, or sofa by placing a rubber sheet upon it; raise the upper portion by placing two bricks or books under it; place a large vessel beneath the lower edge to receive water flowing from it. Now place a blanket on the cot and roll it on each side of the patient so that a trough is formed; the head is also raised. Having prepared a vessel containing water drawn from the cold faucet and a supply of water also in another vessel in which a large lump of ice is floating; several towels, old sheets, and a pitcher, the patient may be treated as follows: If his pulse has lost tension and there are other evidences of vasomotor depreciation, an old sheet should be dipped in plain water, wrung out, and stretched over the blanket; the patient, placed upon the damp

sheet, is snugly wrapped in it. Turning him over so that the back may receive dashes from a height—the higher the greater the mechanical stimulus. Successive parts of the back are douched with a pitcher from a height of six feet or more, not, however, passing beyond the knees, the water temperature ranging from 70° to 60° F., as required. The wet sheet is now rubbed with the flat hands by two or more attendants until it feels warm. Now a smaller stream of ice-water is poured with force upon one portion of the back; this is rubbed and slapped with the hands until it warms up before another is treated. The entire posterior part of the body having been douched, rubbed, and again douched until the hands feel little or no warmth, the patient is turned over and the anterior portion is treated in a similar manner, first by water at ordinary temperature, then with ice-water in smaller quantities, followed by vigorous rubbing and slapping. The patient is then dried and wrapped in blankets, with hot-water bottles to the extremities. When he has reacted—and this should be within half an hour—the rectal temperature should be taken; if it has fallen three or more degrees, the patient may rest for another half hour with a cold turban around the head. If the temperature has not fallen several degrees, treatment must be resumed.

In obstinate hyperpyrexia it will be of decided advantage to place the patient, snugly wrapped in the wet sheet in which he has been douched and rubbed, upon two blankets; wrap these snugly, as in the wet pack you have seen practised in the clinic, around him so that he resembles a mummy. He will probably fall asleep and awake refreshed, with a lower temperature. In cases of hyperpyrexia it is unsafe to allow the temperature to fall below 102° F. while the patient is under the treatment. In cases of a temperature of 100° to 103° F. this treatment will not need to be so energetic. The chief guide must always be the reaction, which implies that the patient must not shiver long and his lips and nails must lose cyanosis and the pulse regain tension. When reaction is feeble or absent, cold douches must not be abandoned. The lower part of the body should be treated by active friction with warm woollen cloths or with the hands and wrapped in warm blankets, while the upper chest and back are rubbed and slapped with ice-water so long as they warm up under the treatment. Quite as much depends upon the duration and extent of exposure to cold water as upon the temperature. Success or failure

will depend upon your judgment and cautious attention to detail in this as it does in other branches of practice.

The Lesson.—What is the lesson I would have you derive from the data presented in this lecture?

1. A judicious application of water results in the saving of life, and an irrational use results in increased mortality.

2. The medical mind appears to be slow in accepting the best established clinical facts, when we find a demonstration like that presented by the fatality of the ice-bath absolutely without result after the expiration of fifteen years. Last summer, anticipating an epidemic of sunstroke, I published in the *Medical Record* a paper on "The Fatality of Text-book Hydrotherapy," in which the facts presented to you to-day were set forth. An evening paper took this article as a text for an editorial. On the following day severe and fatal cases of sunstroke began to appear. Reporters interviewing the assistant medical superintendent of one of your hospitals, published his opinion that the ice-bath is the best method of treating sunstroke, and referred to having served in this hospital when it was used in a severe epidemic. The same opinion was given by other house physicians of another hospital.

That I am not extreme in my estimate of this peculiarity of the medical mind is proved by the fact that it required two thousand years to convince it of the fatality of bloodletting and to return to the Hippocratic doctrine of *Vis medicatrix Naturæ*. The average doctor has not the courage of his convictions, else such indifference to bedside teachings would be impossible. Let us learn a lesson from the Titanic disaster, which teaches certain needs that have been disregarded and the investigation of which may make this awful lesson "a blessing in disguise." If you are convinced of a truth by positive clinical observation sustained as are certain propositions in hydrotherapy by physiological rationale, do not hesitate to speak out again and again until you are heard. It is your mission to guard and preserve the most valued possessions—life and health. Do your duty fearlessly as men and physicians.

PRINCIPLES AND PRACTICE OF SPONDYLOTHERAPY *

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WHEN the neologism, spondylotherapy, was first employed in my book on this subject, no misconception was anticipated concerning its purport. The fact that many of the remedial measures were applied to the spinal region, suggested to the captious critic the possibility of my having invaded the territory of the osteopath and the cheiropractor. I shall endeavor at this time to differentiate spondylotherapy from certain dogmatic methods of practice.

Osteopathy is a system which concerns itself with anatomical abnormalities. "Its nosology is a lesion, its symptomatology a subluxation."

The theory sustaining the system known as cheiropractic presumes that, in consequence of displaced vertebræ, the intervertebral foramina or "spinal windows," as the cheiropractor is pleased to call them, become occluded and press upon the spinal nerves. In this way, the latter are "pinched," and such pinching is responsible for 95 per cent. of all diseases.

In accordance with these respective theories, the osteopath employs the bones as levers to relieve pressure on nerves, veins, and arteries, whereas the cheiropractor by "adjustments" of subluxations eliminates pressure on the spinal nerves.

The theories of the osteopath and cheiropractor are truly at variance with our accepted views of etiology, and, as we shall learn later, by their manipulations they unconsciously evoke reflexes which may be cogent factors in favorably influencing disease.

Spondylotherapy (*G. Spondylos,* vertebra, + *therapeia,* treatment) concerns itself *only* with the excitation of the spinal cord and nerves by various stimuli which may be executed and demonstrated

* Abstract of an address before the "Academy of Medicine of Cleveland," April 19, 1912. Lectures on specific subjects demonstrating the methods of spondylotherapy will be published in subsequent issues.

with the same certainty in the living human subject as is done by the vivisectional experimentalist in his laboratory. In brief, spondylotherapy is based on the clinical physiology of the human being in contradistinction to the study of physiology by the laboratory investigator. Thus human, and not animal, physiology is made the basis of clinical pathology. The clinician no longer regards the pronunciamento of the physiologist as apodictic. We have learned to discredit many statements emanating from the laboratory investigator, not so much because the observations of the latter are faulty, but because there is a considerable difference between a laboratory and the bedside, and a guinea-pig and the patient.

To test a given function one must compare it with a like function in individuals. Thus, if the same quantity of uric acid were excreted in a mammal as is excreted in a normal bird, it would have to be regarded as pathologic.

When I first suggested the phrase "Clinical Physiology," the guiding principle was that, "The proper study of mankind is man." It was Pavloff who observed that "The physician gives a more correct verdict concerning physiologic processes than the physiologist himself."

Hughlings Jackson was pre-eminent as a scientific neurologist, yet he never performed an experiment, but formulated his conclusions in the wards of a hospital. Some of my enthusiastic proselytes have arrogated to me the questionable honor of having created a new system of medical practice.

No system can exclusively pre-empt the field of therapeutics, which is a composite practice founded on empiricism and the practical application of pharmacology and other sciences in the treatment of disease, and the innovationist must create no discontinuity in the transition to new knowledge.

The next endeavor in the exploitation of spondylotherapy was to show that the reaction of the spinal cord and its nerves to stimuli in the living human eventuated in reflexes which could be accurately controlled by the X-rays and other methods of examination. The first reflex thus demonstrated was the reflex now known in the literature as the "heart-reflex of Abrams." It was found when one concussed the seventh cervical spine that there was a marked recession of the myocardium which, as a rule, involved both ventricles in the

transverse and sagittal diameters. The reflex in question is mediated by the vagus through its inotropic fibres.

Pilocarpine by its exclusive action on the autonomic fibres accentuates, and atropine, which paralyzes the motor endings of the vagus, abolishes the heart-reflex.

In concussion of the seventh cervical spine, the blow is transmitted through the spinal nerves to the sympathetic ganglia which form, in connection with branches of the vagus, the superficial and deep cardiac plexus, and it is essentially by this indirect stimulation of the vagus that the effects are attained by concussion.

One must not confound concussion with vibration. The latter is absolutely valueless as a stimulant to elicit visceral reflexes.

In the physiologic laboratory concussion is a recognized method of excitation, and the clinician constantly employs it in evoking the tendon reflexes. Different effects on the viscera are secured according to whether one employs slow or rapid concussions. Thus, vasodilator effects are noted with slow and interrupted concussion-blows, whereas vasoconstrictor effects are observed when the blows are rapid and continuous.

Similar effects are observed in the laboratory. If a mixed nerve is stimulated with the rapidly interrupted faradic current, the effect is constriction. If, however, the induction shocks are sent in at long intervals, vasodilator effects are obtained. Further investigations in spondylotherapy demonstrated that practically all the viscera could be made to contract or dilate by application of the appropriate stimuli to definite vertebral regions.

Primarily, I regarded the visceral reflexes which bear my name as mere physiologic phenomena, but later it was found that they could be employed in the treatment of disease.

In a communication to the "Congress of Medicine" at Lyons, October 10, 1911, Jaworski, of Paris, in reporting my methods, neologized the phrase, "vertebral reflexotherapy."

Unconsciously, we are constantly employing reflexes in treatment. As a pharmacologic paradigm, permit me to refer to the oculist, who, in contracting or dilating the pupil, employs reflexes in treatment. Thus, in iritis, the most valuable remedy is atropine, because, among other effects, the eye is put at rest owing to paralysis of the sphincter.

Take a surgical paradigm. In the operation of resection of the

posterior spinal roots, a method known as rhizotomy, our object is to inhibit afferent impulses from the muscles which excite the cells of the anterior horns to send out excessive motor reflexes to the muscles.

Ample clinical observations permit the conservative judgment that spondylotherapy is only one of the many resources of scientific medicine bearing on the treatment of disease. In conclusion, let me state that I believe (1) that many pathological conditions can be more easily and certainly controlled by spondylotherapeutic means than by the conventional measures. (2) That by the aid of spondylotherapy a specific method of treatment has been found for the symptomatic cure of aneurisms [1] and exophthalmic goitre, and that the results are almost immediate and practically permanent. (3) That the pathology of spondylology is founded on clinical physiology, and its methods embrace the therapeutics of the reflexes.

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[1] Report of 40 advanced cases of thoracic and abdominal aneurisms symptomatically cured by the author in a few weeks. *British Medical Journal,* July 8, 1911, and *La Presse Médicale,* October 4, 1911.

HEADACHES AND TENDER POINTS IN DIAGNOSIS *

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NATURE'S care of the body, whether developed through evolution or providentially acquired, demonstrates a most perfect scheme for protection. Since animals have been struggling for existence and the maintenance of life and health, Nature has offered a defense which has prevented annihilation, safeguarding them in various ways. The discoveries of Ehrlich as to immunity and those of Metchnikoff as to phagocytosis show an elaborate plan for the control of invading pathogenic life. So strongly has the medical mind been impressed by *this* power of Nature that the old truth of the value of pain and its necessitating rest has been almost forgotten.

Nature's first effort tending to the relief of distress or incident disease is through the sensation of pain. Conditions existing without pain and attracting no attention do not bring about the recoveries seen where pain is present.

One of her most important aids in recovery is rest. This is demonstrated in divers ways: for instance, when a tubercular hip begins to ache, the muscles around the joint become spastically contracted, immobilizing it. Thus, in appendicitis a contraction of the abdominal muscles occurs over the site of the inflammation which protects it. Again, it is seen in pneumonia where there is a spastic contraction of the intercostals. So in all instances of local inflammation where pain is prone to be developed there is a reflex contraction of superimposed muscles, tending to rest. The physician's Old Testament should be Hilton on "Rest and Pain"; his New should be found in the works on bacteriology.

A distinction must be made between pain as a sense and the sense of pain. Irritation of the superficial nerves for the sense of pain at the periphery is carried through that nerve in the posterior columns to the thalmus, and it is probably here that the sense of pain is appreciated subconsciously. If the vestibule of resistance

* A clinical lecture.

be low or the irritation intense, the thalmus is passed and the cerebral cortex reached, producing conscious pain; its potentiality depending on two conditions: the extent or severity of the irritation, and the tonus or susceptibility of the individual. In certain races and in city folk where nerve tone is more refined, pains are more keenly felt and the disturbance from them is in excess of that of the lowly or poorly educated, in whom greater trauma can be sustained with less painful reaction.

Embryologically, the brain and cord have a common origin with the skin and its sensory nerves. This may be considered a part of Nature's effort to protect the body by bringing the sense organ in closer touch with the periphery. The effect of irritation to the sensory nerves differs materially whether it comes from the periphery, the skin, or whether from one of the nerves of the inner organs. Painful irritations passing up the sympathetic or through its correlated nerve, the pneumogastric, are always accompanied by more anguish, more mental dejection and depression than those coming from the periphery.

Pain is Nature's warning that some harm is being done, that there is some insult to the physiological functioning of an organ or tissue. Instinctively a person submits himself or herself to the desire for rest.

HEADACHES

Headache is an alarm that somewhere, either in the cranium or in the body, something is going wrong. Every one intuitively appreciates the importance of disturbing conditions in the neighborhood of the mind centre. No more important point could have been selected for the call of danger than this portion of the body.

To better understand headaches the anatomy of this region must be clear. The brain has no sensory nerves. The dura is a dense, non-elastic membrane of fibrous tissue. It is plentifully supplied by sensory as well as vasomotor nerves; namely, branches of the trochlear, ophthalmic, semilunar ganglion, vagus, and hypoglossal of the cerebral group, and the sympathetic. Any affection of the vasomotor system which allows of distention of the blood-vessels in the dura would naturally lead to disturbance of the terminals of the sensory nerves with the production of pain. When the number of cranial

nerves distributed to this membrane is considered, and their anatomical and physiological importance appreciated, it is not to be wondered that disturbances in any part of the body may be reflected or referred to the dura.

The epicranium is supplied by the tri-facial, facial, and great occipital. Histologically, the epicranium is somewhat similar to the dura, but it is not so dense. It has a more moderate nerve supply, having but three nerves, the two cranial and the cervical. One would judge that its importance in the origin of headaches was less than that of the dura.

It is very evident that the symptom headache warns of many conditions, both local and systemic. Any tissue composing the caput, whether the soft brain, the bones of the face and skull, or the membranes, becoming affected either through local or systemic conditions, may give rise to the symptom headache. Rarely, if ever, are pains noted in or around the head without some other symptom being present, either referred to the sensorium, the nerves of the scalp, or some viscera.

Headaches may be variously divided. In order to use this symptom in differential diagnosis we must leave its pathology and cling to its point of localization. Headaches may be primarily dural, or they may be an affection of the nerves of the external part. Headaches due to changes in the dura have a larger systemic symptomatology ordinarily than those of the peripheral nerves. In them we read a louder call for protection than in those of the superficial type of painful troubles. Diseases of the body associated with toxæmia more generally affect the vascular supply of the dura, either through the pneumogastric and its associated nerve, the sympathetic, or through the fact that the toxins may have a selective action on intracranial nerves.

Headaches are of three types:

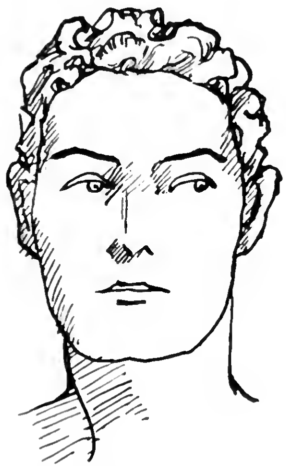
(*a*) Those produced by the affection of the structures of the cranium and its contents.

(*b*) Those due to disease conditions existing in the bones of the face, where the pain is reflected upward along the course of a nerve.

(*c*) The true neuralgias of one branch or another of the fifth nerve.

Headaches proper do not follow the course of a nerve and are

Fig. 1.



Unilateral varieties of headaches.

Fig. 2.

Bilateral varieties of headache.

(For explanation of figures, the reader is referred to the text.)

difficult to locate accurately. The following is an attempted tabulation of the various kinds:

1. Neuralgic-nerve tender at foramen of exit.
   Sharp pain following the nerve.
   Lancinating in character.
   Occurring in those predisposed to neuralgias.
   Generally caused or aggravated by toxæmias.
   Cured by tonics and regulation of the gastro-duodenal tract.
2. Aching along the course of the supra-orbital nerve.
   Somewhat tender.
   More of an ache than a neuralgia.
   Periodic. On second day transferred to other side of face.
   Associated with intestinal toxæmias, defective digestion and metabolism.
   Aided by hygiene of the intestinal tract and vigorous outdoor life.
3. Sharp, stabbing, severe pain running along course of supra-orbital nerve.
   Associated with great tenderness and facial spasm.
   Lasts for days.
   Known as tic douloureux.
   Relieved by general body hygiene, high frequency electric current, resection of nerve, and alcoholic injections.
4. More or less severe pain, with fortification spectra noted on first day.
   Associated with severe nausea and vomiting towards the end, recurring with pernicious regularity, not relieved by any treatment—indicates megrim.
5. Ache over one eyebrow, particularly in morning.
   Associated with nasal catarrh.
   Caused by empyema of the antrum.
6. Rather diffuse pain over one eye, inner side, with tenderness, particularly on percussion at root of nose.
   Characteristic of sinusitis, frontal.
7. Fronto-vertical headache sometimes points to decayed incisors and eye-teeth.
8. Occipital unilateral headache may indicate a decayed molar in lower jaw on that side.
9. Pain circumscribed in temporal region—decayed molar in upper jaw.
   Sometimes associated with graying of the hair in that region.
10. Pain further forward—decayed molar in lower jaw.
11. Lateral headache running up in front of the ear to the vertex often indicates diseased tonsil and mastoid.

Bilateral—

12. Pains in low forehead and extending indefinitely towards base of brain.
    Associated with sensitiveness of sight.
    Sometimes slight tenderness of skin.
    Pain throbbing.
    Aggravated by stooping or sudden motion.
    Probably dural, congestive.
    Due to constipation and intestinal toxæmias.
    Cure—proper regulation of *diet* and bowels.

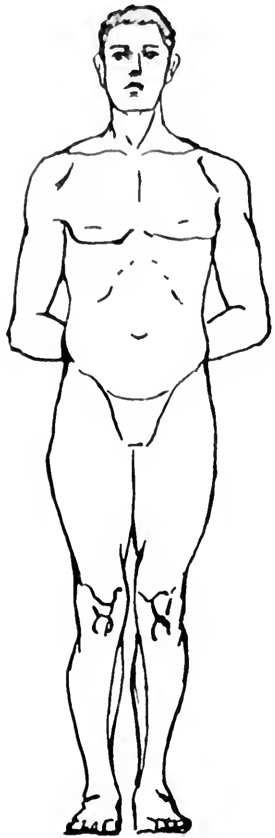
13. Pain in forehead, somewhat higher than eyebrow.
    Deep.
    Due to some perversion of stomach or duodenum.
    Relief obtained by acids.
14. Aching further up on prominence of frontal bone indicates some perversion in same neighborhood.
    Relieved by alkalies.
15. Pain in low forehead between eyebrows indicates irritation in vault of the palate.
    Seen in the rapid eating of ice cream.
16. Pain bilateral, frontal, or frontotemporal.
    Felt on waking, passing away in a few hours.
    Throbbing, sense of tension, and lassitude.
    Tendency to urticaria, chilblains, and angioneurosis.
    Relieved by calcium lactate.
17. Mesial headache, circumscribed, junction of forehead and hair-line, generally indicates tension in some of the facial sinuses.
18. Indefinite occipital and frontal headaches brought on by use of eyes mean eye-strain.
19. Occipital headaches may be neuralgic, following the great occipital.
    Accompanied by tenderness.
    Due to some toxæmia or to malaria.
    If associated with nephritis—uræmic.
    More rarely, intestinal toxæmia.
20. Occipital pain may occasionally indicate an intrathoracic tumor in patients the subjects of aneurism of the arch.
21. Pain on top of head, deep-seated, with sense of pressure, indicates pelvic lesions, anæmia, associated with so-called neurasthenia.
    If it is like the driving of a nail, particularly in women, hysterical condition.
    Relief of both—cold spongings to head and spine, frequently applied, followed by vigorous rubbing, general hygiene, and tonic treatment.

Diffuse—

1. General diffuse headache, associated with gastric disturbances, rise in temperature, with slight or considerable obtuseness of mind, indicates onset of some febrile condition.
2. Associated with contracted pupils, sensitiveness as to sounds, with rigidity of muscles of neck, indicates cerebrospinal meningitis.
3. Localized severe pain, worse at night, continuous, associated with choke disc, gastric disturbances and vertigo, may mean regional meningitis or tumor.
4. Severe general headache in pregnant women, associated with epigastralgia, diminution in the visual field, alteration in the partition of nitrogen in urine, is a prodrome of eclampsia.

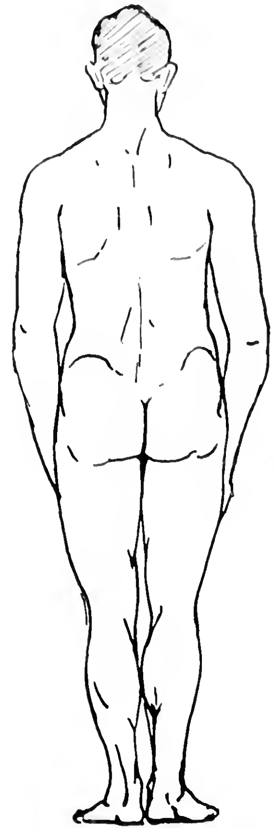
Through some chemico-physical or histological defect in the "pain-centre," to use a comparative term, we may have sensations originating there, referred by paths of least resistance to the periphery, thus accounting for hysterical hyperæsthesias and pains. The

Fig. 3.



Tender points on the anterior surface of the body.

Fig. 4.



Tender points on the posterior surface of the body.

(For explanation of figures, the reader is referred to the text.)

vertical clavus and its analogue, coccygodynia, may thereby have central foundations.

In differential diagnosis of disease conditions the study of headache is valuable, provided the headaches be *studied,* and, to be studied properly, examination of the scalp and contiguous tissues should be as systematically made as has been the habit in thoracic and abdominal lesions. A careful study of the history of the headaches of a patient will sometimes aid one in suspecting otherwise unexpressed lesions of the body.

TENDER POINTS

Passing from the symptom headache to tender points as a sign of existing lesions, we obtain further and more important information for diagnosis. It was Valleix who, in 1841, first noted tenderness in certain points in the course of a nerve, thereby differentiating between so-called neuralgia and other painful conditions. From that time to date we have come into possession of facts which enable us better to comprehend reasons for local tenderness and to give them proper interpretation.

Local tenderness may be induced by three conditions: first, circumscribed inflammation; second, possible alteration in a certain part of the course of a nerve; and, third, alterations in the sympathetic ganglion, the result of continued irritation of some nerve branch.

Tenderness due to local inflammation is general as to the organ or part affected. It is never a tender spot and has no direct connection with the nervous system. Its special significance in diagnosis is very different from the reflex tender spots under discussion.

The other two types are more or less constant as to location, and are either reflex or referred points of tenderness. The study of tender spots will be facilitated by taking the regions of the body seriatim rather than by separating those of the neuralgic type from those of the ganglionic. Where an affected nerve passes through a facial aperture it may acquire supersensitiveness. This is seen in the so-called Valleix's points in the intercostal nerve. Valleix extended his observations to a considerable part of the body, and may have exaggerated the importance of this diagnostic sign, but it holds with much value in this one place, differentiating it from pleurodynia and inflammatory conditions. We find it, however, well accen-

tuated in the nervous type of headache at the point where the fifth nerve emerges from its foramen.

Sub-mammary.—Under the left breast in the fourth or fifth intercostal space at Valleix's point we sometimes get persistent tenderness and continued pain. This is seen only in women and is a reflex effect from some chronic sclerotic condition of the uterus and adnexa, or a pelvic condition associated with the pinching of a nerve.

Over the apex of the heart we have a point of cutaneous hyperæsthesia where pressure with the stethoscope is painful in those lesions of the heart where the muscle is overworked and strained.

Myositis Dolorosa.—Myositis dolorosa is a disease little known, much neglected in literature, and best comprehended by the Swedes and Norwegians, whose practitioners employ massage in the treatment of muscle lesions. In those countries the doctor examines and massages his own patients, and he acquires a delicacy of touch and refinement of diagnosis that cannot be fully appreciated by those who refer their cases to masseurs, as we in America know them.

Many so-called occipital headaches are lesions in the muscle of the neck. Here, in the gluteus maximus and in the muscles of the thigh, we find spastic states, hardening of the muscle, and points of exquisite tenderness, indicative of sclerosis with pain. This condition is generally brought about by traumatism and is only relieved by deep, vigorous, and repeated kneadings with the finger tips, bruising of the parts, breaking up of adhesions, and promoting of exudate absorption.

Knee.—In synovitis at the knee there is a point of tenderness where the internal lateral ligament is attached to the head of the tibia.

Renal.—A tender spot at the tip of the twelfth rib is present in cases of pyelitis with tension, particularly when renal calculi exist. It is fairly constant and always found on the side of the lesion, even though the pain be referred to the other kidney. In examining for this, pressure should be made in the soft part around the tip. If it be found free from sensitiveness and the tip of the rib tender each time pressed upon, its significance may be accepted. The intimate relation between the posterior root of the twelfth nerve and the renal ganglia of the sympathetic accounts for this.

Pancreas (Robson's Point).—Robson has given us two points in the upper abdomen. One inch above the umbilicus in a mesial

line we obtain tenderness on pressure in pancreatitis. This may be a tenderness of the first class, not strictly a neuropathic condition, but in the majority of cases it holds constant as to position, and is very valuable in diagnostics.

Gall-bladder (*Robson's Point*).—In cholecystitis we may have tenderness at a point one inch from the umbilicus on a line drawn diagonally up to the mesial line. In nervous dyspepsia due to irritating effects of chronic appendicitis associated with cholecystitis, tenderness at this point is most helpful in differentiating between the many lesions which occur in this complex portion of the abdomen.

Epigastrium.—In the epigastrium, just below the tip of the sternum, is an area of tenderness associated with a distress known as epigastralgia. It has a broad significance and is often associated with pulsation at the cœliac axis, divergent recti, and some chronic nip in the periphery of the abdominal sympathetic.

Appendix—Acute Appendicitis (*McBurney's Point*).—Lesions in the lower abdomen give two types of tender points, acute inflammation of the appendix inducing a point of hyperæsthesia known as McBurney's, one and a half inches from the anterior superior spine on a line towards the umbilicus. It is fairly constant, except in cases where the appendix is lower or higher than normal, when there is sometimes a shift.

Chronic Cæco-Appendicitis (*Monroe's* and *Morris's Points*).—Monroe's point at the margin of the rectus running on a line from the spine to the umbilicus is approximately over the ileocæcal valve, and Morris's point, one and a half inches from the umbilicus on the same line, over the upper ganglia of the hypogastric plexus, pressure on which becomes painful when the plexus is exhausted by steady drag, such as is seen in conditions of chronic cæco-appendicitis, where the nerves of the appendix are pinched by contracting tissues. There is another point of tenderness characteristic of chronic cæco-appendicitis. It is one and a half inches below the umbilicus and half an inch to the right.

These points should all be tested in examination for chronic cæco-appendicitis, and every conscientious practitioner should endeavor to become familiar with them. A carefully-taken history should be obtained in every case of suspected cæco-appendicitis or stomach trouble. The intimate correlation between the two has been

so thoroughly proven that no physician is doing the best for his patient or for himself who does not try to work out the broad pathology which commonly exists in the abdomen.

Every case of chronic appendicitis is disturbing some one or another of the viscera. To put an appendix in cold-storage, thereby postponing operation, is a sin against the individual. In all abdominal cases each tender point should be looked for and the possibility of "suggestion tenderness" eliminated by repeated examination and by distracting the attention of the patient.

In chronic appendicitis Morris's point is always tender, Monroe's somewhat so, and McBurney's never. In subacute appendicitis with hyperplasia, Morris's point is tender, Monroe's and McBurney's equally so. In acute appendicitis the first condition is reversed: McBurney's point is tender, Monroe's at times, and Morris's never, unless (as not uncommonly happens) there be an acute attack on top of a chronic one, when there will be tenderness at both Morris's and McBurney's points.

Chronic Salpingitis.—In order to differentiate between chronic salpingitis and chronic cæco-appendicitis, press the point to the left of the umbilicus corresponding to Morris's point on the right. If both are tender, one may be suspicious of a lesion in the pelvis. If the right is considerably more tender than the left, then chronic cæco-appendicitis with salpingitis may be suspected.

Coccygodynia.—There may be tenderness at the *tip* of the coccyx, not at its sides nor on its body. This condition has often been mistaken for a local trouble and the coccyx repeatedly removed, but the pathogeny is drag on the broad ligaments with drain on the ganglia impar and reflection of a sense of pain to the tip of the coccyx. The treatment of this is always to the uterus and adnexa.

Testicle.—In lesions of the testicle we have a tender spot where the cord passes into the external ring.

Hepatic and Stomach Lesions.—In hepatic lesions we may find a tender point on a line with the tip of the scapula on the right, and in gastric lesions, one at the left.

Spine.—There are several points of tenderness over the spine which should be better comprehended than they are at present. The recent researches by Dr. Albert C. Geyser on the application of the electric current in diagnosis allows of more exactness. He uses a

faradic coil as follows, quoting from his reprint on "The Underlying Cause":

> One pole of the battery (it does not appear to make any difference which) is attached to a six-by-six-inch moist electrode, and applied in front over the epigastric region; the other, a smaller electrode, two by two inches, well moistened, is passed lightly over the spinal column, with a current strength only sufficient to be agreeably felt by the patient. Pass this electrode up and down the entire length of the spinal column with ordinary pressure, eight to ten times, remove the electrodes, when it will be found that we have bodily outlined upon an otherwise white background vivid red spots.
>
> These spots for some minutes after the current is removed tend to become even more prominent and more sharply circumscribed. If we now make digital pressure upon any of these indicated spots, we shall find sensitive or painful areas, while no pain will be complained of in the intermediate region.
>
> These pictures in a short time become almost pathognomonic of certain ailments, and, with an exactitude that is surprising, point to a location of the particular region or organ involved, so that the observer can make a diagnosis from the reflex centres involved.
>
> The explanation of this phenomenon is neither mysterious nor difficult; if we remember the nerve connections just prior to the entrance to or exit from the spinal canal, and if we bear in mind the effect of irritation upon any tissue, then we have a clear conception of why the sympathetic nervous system should respond so readily to our irritation, and why the more irritated centres (from other causes) should respond before even the normal tissue appreciates the irritation produced by the current.

To obtain the greatest value in examining for tender points one must remember that the mind of the patient should be distracted, otherwise the imagination suggests tenderness where it really does not exist. Pressure should be made at different points and the susceptible and negative results predicted. If each time pressure be made at the orthodox place with coincident tenderness, then the result may be considered reliable. Occasionally, however, repeated pressure apparently diminishes the sensitiveness, so prolonged examinations may tend to make them futile.

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PSYCHIC HYPERTENSION: RESTORATION OF MIND CONTROL BY MOTOR TRAINING IN RELAXATION

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Mind control, and especially loss of control, is a factor in a multitude of clinical problems. Loss of mental poise often nullifies good treatment, and, when not judiciously reckoned with, is capable of defeating the best remedial measures.

It is difficult enough, in a puzzling case, to determine whether we have to deal with concealed decrements of courage, exhausting anxieties, or other classifiable mental distresses or weaknesses. Perplexing to the last degree is a state of strained attention, of anxious, exhausting repression, which may be called *psychic hypertension*. Observing practitioners will recall meeting with instances of wastefully suppressed energy, or its opposite, prodigality of action, steadily sapping gravely-needed reserve forces; of agitations, often well hidden, inducing reflexly distressful perturbations, especially in the psychomotor sphere, and reacting hurtfully upon nutritive and other vital processes. One becomes aware of this depleting mental overtension by instinctive sympathetic appreciation rather than through ordinary channels of information.

The evidences are from manifold sources and indications, and are not readily describable. They are revealed by chance findings; one must be always on the lookout. If they are overlooked or wrongly handled, almost any kind of disease or functional derangement becomes more obdurate, recalcitrant, and the wisest treatment is rendered ineffective.

The subject was brought to my attention long ago by studying some puzzling chronics which had baffled better men. A natural desire to find the hidden key and render service where others had failed stimulated my endeavor to take a wider view, to get a sense of proportion, and search critically along the whole line of somatic phenomena.

If psychic hypertension be present, it has been my experience that gratifying relief of puzzling phenomena often follows simple exercises in mind control. Mere explanations, elucidations, careful directions, appeals to reason, to spiritualities, to faith in Nature's God, and the like, were not enough. Many of the cases were devout women and blameless men.

They had passed through what William James calls diverse "varieties of religious experience"; a lot of them had run the full gamut of Mother Eddy's perilous optimisms. After all is said, claimed, and classified, a man is not a disembodied spirit, but the highest type of intelligent animal. Although you can deny sin, deny disease, assure yourself that you are heir to a seat at the Throne of Grace, you still "dwell in a house of clay"; that is, a body like unto your fellows, which, to live and move and have your natural being, must eat, sleep, and, above all, work. So long as the complex functions of the much-abused civilized body run smoothly all is well; you can serenely deny anything you like, except one thing: that the essential condition of life is to work. Now, work is the product of action: good work, of normality in the sum of actions.

All persons are subject to variations in powers of self-control; to ups and downs of energy, impulse, emotion, action, judgment. Elevations or lowerings of capacity, of feeling, of progressiveness (conscious or unconscious) change from day to day, often from hour to hour. Some exhibit large variations of energy only at long intervals; occasionally to such a degree of gloom as simulates grave mental abnormalities. These moods or aberrancies of feeling-tones may be recognized, or remain so obscured as to escape awareness. During these tangential flights of force, or lapses from control, character changes, the sense of proportion is lost, customary standards of conduct or decision are obscured or fade away, instinctive defences, normal inhibitions evaporate.

Oscillations are peculiar to the realm of feeling, usually dependent on changes in the somatic realm and modified by accidental factors—environment, dominating stimuli from without or within.

Determinants of conduct are moods, emotions, feeling-tones. They in turn influence beliefs and likewise somatic states. The most forceful, the most prevalent modifier of decision is some form

or degree of fear, anxiety, apprehension. Then are cells, tissues, secretions, and, above all, centres affected, oftentimes seriously, and organic damage may result.

The power of idea, reason, choice is limited; that of indirect, accidental influences, tremendous. Even faith must not be too blind. Bad habits of mind and body evolve chiefly from indecision, apprehension, fear; seldom from overconfidence or aggressiveness. Few of those who seek or need medical advice are free from some degree or form of anxiety neurosis. Only among the acute diseases can we feel confident that this feature is absent; even here it may occur and modify vital processes.

The causes of hypertension states are complex. A crude classification of instances commonly met may be: those due to (1) inherent over-sensitiveness to emotional influences, and (2) faulty habit formation acquired along the whole range of training processes.

The factors include variations in feeling-tones beyond normal or customary limits, in intensity, in periodicity, in slight disintegrations of mental phenomena, commotions in somatic processes, unusual reactions to stimuli, aberrant impressions. Some element of apprehension is usually present, often coupled with heroic endurance. In eccentricities of belief the emotions are thrown just a little out of gear, inducing disarrangements in the motor sphere.

Attention is tension in nerve-cells. Neurons which at any time furnish a physical basis for varying attention are subject to a thrilling vibration or quivering. There is voluntary and involuntary, or reflex, attention. Reflex attention is forced upon consciousness by external stimuli. These react upon visual, auditory, olfactory, or tactile centres and compel attention against the will.

Voluntary attention is correlated with heightened activity in cortical brain areas. Anxieties increase morbid hypersensitiveness and the whole makes for agitation, even turmoil, in the motor spheres. Tense voluntary attention, long continued, will weary the strongest brain. Protracted over-stimulation induces exhaustion in brain cells, till they shrink and become impaired. Muscular energy is so closely associated with the integrity of neurons that all influences affecting them become of extreme significance, whether bearing upon mental or physical competency. Psychic hypertension is a manifes-

tation of habitually strained attention. There is present all the time more or less of physical strain, leading to perturbation in volition, to unhinging of capabilities.

It is a well-known clinical fact that attention strongly and continuously directed to any organ will induce functional disturbance. Consciousness becomes dulled by repeated responses to, or irregularities in, stimulation, hence it falls below the threshold; but there remains the effect of perturbation; viz., the arythmias persisting and manifested in the motor machinery. There is frequently exhibited a state which when revealed is psychic hypertension.

Sensations incite to action and in terms of the original capacity and the subsequent habituation of motor paths and centres. Unless proper association fibres in the brain are developed by suitable nutrition, orderly adjustments, and right training, there must result both motor and sensory, and hence intellectual, limitations. Sensation tends always to pass into movement. If there be no image there will be no concept, and no concept can be formed without an accompanying motor outflow.

Ideas differ in the proportion in which the motor factor stands to the other elements. In some persons ideas spring to life in profusion, in perfection, and instantaneously; others require much time, and then ideation is often unclear. Training can do much to enhance or retard. Interferences with normal ideation are induced by volitional insults, by inhibitions, counter-influences. Many of these adverse influences are the product of doubts, indecisions, disappointments, fears. Pent-up motor energies are thwarted, hence result psychomotor overtensions.

Motion alone produces, achieves; hence the importance of right training to conserve energies. If defects are observed in method, there is a need for retraining to enhance efficiency. Energies must be directed to definite ends. An idea is barren unless executed in some concrete fashion. Interruptions of ideas may be useful if the flow is directed into useful channels; if merely inhibited, they die; if suppressed, confusion results.

A reflex movement in neurons lies at the basis of every higher act of volition. The idea of an act tends to indicate movement. The consciousness may form a concept of the consequences of the act and check it. This second idea may suggest a modification of the act,

or an opposite one. That which modifies the will is often anxiety. Fatigue may inhibit; nothing is so exhausting as long-protracted attention. Doubt, indecision, is thus induced. Exhaustion follows.

To analyze a suppressed complex is the first step to solution; the next is carefully to trace out the primary steps of advance, to go over the ground from the beginning. After determining the *status quo,* the next step is to show how future advances can be made without committing former errors. This involves instruction in right habit formation.

Right habit formation is based on right guiding in motor impulses, and is essential to right thinking. New paths must be plowed out in motor soil, old paths revised; thus facility is restored and enhanced. Nor should any habit be permitted to become too fixed. Capacity for variation is priceless; thus new and shorter routes can be travelled in the brain. When this capability is gone, then is the organism a derelict indeed.

It will then be plain that psychic hypertension is closely associated with anxiety neurosis and with unconscious muscular hypertension. The clinical significance seems obvious enough, though requiring fuller investigation. In my personal work increasing attention is given to the elucidation of these puzzling phenomena. In many instances the curative principle needed was revealed by accidental findings.

I have been accused of over-enthusiasm for motor training, the outcome of early attention to manual and orthotherapy. My experience in the advantages of systematically training neurotic folk in relaxation long ago convinced me that when the accomplishment was acquired many perplexities evaporated. Not only so, but the somatic complexities became simplified, remedies hitherto resisted began to do their perfect work; desired results, long delayed, appeared, and, what is more, remained. The desideratum is balance between determination and execution.

A large proportion of the benefits derivable from any kind of graded motor training depends for its chief efficacy upon tranquillizing effects on mental turmoil. Exercise is almost universally conceived to be strenuous muscle-making, which, valuable as it is, may readily exhaust and harm, especially when not wisely directed. Perhaps in time mankind will learn that exercise is a normal and needed

use of motor machinery, developmental, educational, or reparative.

The reparative potency of exercise is popularly viewed with extensive misconception: sometimes with over-enthusiasm, and often with ridiculous and reasonless condemnation. The aspect of reparative exercise here considered is its power to induce the condition, and, above all, the *habit,* of tranquillity, calmness, equipoise; to alleviate fatigability; to rehabilitate energy by encouraging the output of force just enough to accomplish self-control; to attain that position of advantage from which all latent forces may economically proceed to highest achievement consonant with inherent dynamics. Let me cite as illustrative of splendid poise and conscious power a thoroughly well-endowed athlete of comprehensive capacities. No more beautiful embodiment of human efficiency, of ease and precision of energizing, is to be found. A long familiarity with athletes enables me to speak with confidence. Only those become champions who are possessed of perfect equipoise. Then, too, they do more, of greater variety, independent of stature, conformation, or any crude evidence of powerfulness, and they do it more pleasurably to the eye of the beholder. And, above all, they do not break down, but last indefinitely and attain serene old age.[1] Every trainer knows that a man may be endowed with superb dynamics, and yet prove inefficient in competition until psychomotor faults are corrected by laborious training in correct economic habitudes. If, then, it be demonstrable that so large a need exists for training and retraining even a selected, highly-endowed individual, how much more essential is it for the ordinary citizen who falls below the norm of vigor through protracted ill-health to bestow at least a fair amount of attention on training the working machinery!

What, then, are the best measures for securing that motor equipoise so essential to mental serenity, hence for all-round efficiency?

Briefly, intelligent direction in forming habits of periodic complete relaxation, by alternations of definite, simple, primitive motor energizing, with insistence on equally clear-cut periods of absolute rest, stilling of the mind.

When the first steps of mind control are established, then one can proceed to more complicated, purposeful acts, interspersed with in-

[1] I once made a study of old athletes (see "Influence of Bodily Exercise on Length of Life," *Jour. Amer. Med. Assn.*, June 4, 1892).

tervals of repose. Ultimately, as progress in peacefulness warrants, there should be taught systematic habituation in the performance of motor acts making for amplification in vigor and effectiveness. The Oriental, especially the Hindu Yogi, seems to have been the pioneer in these accomplishments. The Yogi magnifies the cultivation of *Prana,* or the highest conception of vital force. This is acquired through the practice of breathing acts, elaborately taught; constituting an education in respiration, with certain mystical ideas inculcated. To this they add a number of purposive acts of extension and flexion. Marvellous effects are achieved by this training, in the control of both body and mind. My experience with teachers of the art of "the complete breath" impresses me with its value far beyond what might be expected from such a simple practice.[2]

The Greeks elaborated systems of body training whose objects were æsthetic and martial. The additional effect of reposefulness was not made a prominent feature, but obviously this followed. Expression of emotion through dramas, histrionic impersonations is efficient for inducing exhaustion or composure and serenity in actors or spectators. Our modern methods of physical culture exhibit varied and often contradictory features. Some are creditable and some wholly objectionable. They will be discussed elsewhere.[3]

Indeed, all the best training methods emphasize fundamental principles of mind control as the condition of complete body control. The so-called "Swedish movements" are effective in this particular. I have had instruction from scores of Swedes, Norwegians, and Germans. Many of them display no appreciation of rest periods. The sharp, sudden, jerking movements they teach fatigue all but the strongest.

Playing on certain musical instruments can be made of value for

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[2] "Hindu Yogi Breathing," by Yogi Ramacharaka.

[3] Among the score or more of "systems" which I have been at pains to learn (with a view of selection for use in reparative training), one of the best for the attainment of *equanimitas* is that of Allen Lester Fowler, consisting of two features combined: (*a*) a deliberate, forceful expiratory act, and (*b*) at the same time a simple flexion or extension. This is capable of wide variation, is safe, sane, and efficient. The subject may lie, sit, or stand, as vigor progresses.

The methods of Edwin Checkley are of equal value in a wider sphere, both for securing poise and muscular power and control. His watchword was: "*Loosen up, let go, become quiet, rest between acts,*" etc., and, as he passed many years in India, probably reflected the Yogi teachings.

serenity. So of dancing (*e.g.*, the Raymond-Duncan Greek dances), vocal training, singing, elocution, etc., always directing the emotional tide in reposeful or tranquillizing channels. Among the more robust, invigorating forms of athletics, that of fencing best exemplifies the value of poise. Old *maîtres d'armes* frequently exhibit superb composure. Nowhere in the domain of competitive exercise is perfect equilibrium more conspicuous than in the use of the small sword. Strained attention in fencing unfits the performer for the swift, accurate lunge, the *touche,* which demands perfect physical and mental equilibrium, along with the acme of precise, well-directed muscular effort, from perfect poise with gradual increments of power to the poise of fullest tension, a parabolic curve of well-balanced force. In short, contrary to popular opinion, the whole category of competitive exercises is in reality calculated to induce endurance and superiority, the factors of which are poise, elasticity of tissue, and absolute control of every volitional act.

Finally, a brief sketch is offered of procedures to be followed in teaching mind control. The first desideratum is to induce quiet, a receptive attitude. For this a recumbent position is best, or that in an easy-chair, the eyes closed, to dissociate the subject from all sources of external irritation, a withdrawal from the life of relationship. Next, full, candid explanation of the objects to be attained; the value of routine or ritual; the fact that responsibility rests wholly with the subject, the seeker for help, on himself alone. Outside help may and does contribute largely to success, but only by pointing the way, affording the benefits of broader research, principles of action learned by composite and personal experience—in short, only what any expert guide or director can supply of stimulus to personal action. The subject must be made aware, also, of the immense, unused energies latent in every sane human being, vastly greater than are needed or ever rendered available, which can be drawn upon confidently and unendingly. The mines of force are inexhaustible; success is merely a question of getting out the materials and adapting them to actual use.

The routine may be somewhat as follows: After inducing passivity and receptivity, direct attention to one limb; mention that this can be moved, extended, flexed at will, but now it is determined to encourage equilibrium, let the will abide in a negative attitude, neither

push nor pull, rest at ease. Then direct the mind to pause an appreciable time, erase all impressions, recollections, determinations. Next, direct attention to other limbs in turn and to the muscles of the back, etc. Composure thus induced is oftentimes so great as almost to reach slumber. It is not sleep, but so pronounced and unaccustomed a calmness as to create the idea of somnolence. The effect is largely in the psychomotor domain; it is an exercise in tranquillization, in submission to one's own enlightened volition; it is reason resuming the throne; a becoming captain of one's own soul. From this serene point of vantage, this fount and origin of judicious action, one can then proceed to any sort or kind of purposive energizing. Direction may no longer be needed. In most instances, however, better results are ultimately reached by systematic, graded increments in action, and complexity of movement, in carefully-planned forms and kinds of exercise, until a re-education in the more elaborate adjustments of daily life is attained. The motor element is paramount throughout. Biologically, thought follows motion, however much action may seem to spring from thought.

THE RÔLE OF THE STREPTOCOCCUS

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As a result of new discoveries since Koch first saw the *Streptococcus* in 1878, our ideas concerning this important pathogenic organism, and particularly its therapeutic uses, have recently been greatly changed. Many different species or varieties have been recognized, but these rest largely upon some one peculiarity, often evanescent, which makes any differentiation impossible with our present knowledge. We may conclude, then, that there are a number of varieties of *Streptococci,* but that we have no very accurate methods of classifying them. From the standpoint of diagnosis, this difference is not very important, but from that of therapeutics it is often vital.

The *Streptococcus* grows in chains of rounded or slightly flattened spheres, varying in number from two to a hundred or more, the individual organisms ranging from .3 to 1 micron in diameter. The chains are usually slightly curved, and are sometimes interwoven most intricately. Under artificial conditions of growth, the development of the organisms is slow and often unsatisfactory. Many special culture media have been introduced, planned to cater particularly to the peculiar needs here demonstrated. Some of these work well, but as a general routine the one most frequently used with success is the plain gelatin-glucose-agar slant, upon the surface of which has been smeared a drop of sterile human blood. Upon such, the *Streptococci* will appear in about eight to sixteen hours as minute dots or points that do not tend to grow much larger as they become older. Some varieties will produce hæmolysis of the blood, others will not. These colonies simulate very closely those of the *Pneumococcus,* which also grows well on this medium. Differentiation between the two can usually be made by the microscope, although at times there is such a close resemblance that one cannot definitely decide by this means alone. This is particularly true when the

Pneumococcus grows in chains and when its classical lanceolate shape is indistinct.

From the standpoint of diagnosis one must remember that not only is the cultural growth indistinct and slow, but that, clinically, there is often an association with the *Staphylococcus*. As a result, cultures made from such may show the *Staphylococcus* alone, the *Streptococcus* having been entirely overgrown. This will explain why a culture alone of a suspected case will often give erroneous results and lead to incorrect deductions. In every case where *Streptococci* are to be searched for, a smear of the material to be examined should be made and studied after staining. This is not only more accurate, but more rapid as well. And then, if such association or double infection is found, dilution cultures may be made to prevent overgrowth by the more active vegetative organism, and to enable one later to pick out individual cultures for further use.

Having found in the case the causative *Streptococcus* and having isolated it in pure culture, a consideration of the pathogenesis may be considered before taking up the vital problem of our topic, the production of immunity.

Streptococcus pyogenes in man produces a variety of lesions, dependent partly upon the site of infection and partly upon circumstances at present unknown. Among other diseases thus found we find septicæmia, puerperal infection, erysipelas, meningitis, mastoiditis, carbuncle, otitis media, various inflammations of the accessory nasal sinuses, pharyngitis, bronchitis, bronchopneumonia, endocarditis, peritonitis, empyema, osteomyelitis, and arthritis. Others might be cited, but will be taken up later in another connection. The results of the infection, once established, depend on the particular part affected, on the virulence of the organism, and on the resistance of the individual. Just why organisms of the same strain produce septicæmia in one person, tonsillitis in another, and meningitis in a third may probably best be explained by varying degrees of local resistance, although this explanation is often inadequate. The virulence of the organism varies greatly, depending largely upon preceding conditions and environment. *Streptococci* that are isolated from recent severe infections may be highly virulent when first cultivated upon artificial culture media, but will gradualy lose their potency upon being subjected to repeated subcultures. Later, those slightly virulent cultures

may become much more virulent by rapidly passing them through a series of susceptible animals. In other words, we are able to increase or decrease the disease-producing ability of the *Streptococcus* somewhat at will.

An explanation that is given for this is the well-known one of adaptation, common in the animal as well as in the plant world. In a given culture, certain organisms are particularly pathogenic, certain others particularly vegetative. When passing rapidly from animal to animal the pathogenic ones thrive most luxuriantly at the expense of the others, while on artificial culture media the slightly pathogenic but highly vegetative cocci find conditions favorable for outnumbering the others. These facts are of great importance in artificial immunization, as will be noted in proper sequence. The clinical results following streptococcic infection are often out of all proportion to the local lesion and strongly suggest the presence of a very potent extracellular toxin. Attempts to isolate such have, however, been rather unsuccessful, and probably on this account the production of antistreptococcic serum has met with only indifferent success. There seems to be, in addition, a distinct and less varying intracellular toxin intimately connected with the bodies of the cocci and only set free by bacteriolysis, usually occurring in the fluids of the host.

A consideration of the question of streptococcic toxins would be incomplete without comment upon one rather novel use to which they have been put in therapeutics. Reference is made to the administration of the toxins in sarcoma as introduced and recommended by Coley. By him it was observed that, following occasional accidental infection of malignant tumors with erysipelas, the tumors sometimes subsequently disappeared and clinical cure followed. He concluded that the favorable results were due to the streptococcic toxins, and from such conclusions he built up a method of therapy supposed to be particularly valuable in sarcoma. Coley recommends the preparation of the bacteria-free toxin of the *Streptococcus* in combination with that of *Bacillus prodigiosus* for the most potent preparation, a method devoid of the dangers of the original, where the patient might die of the living *Streptococci* while being treated for the tumor. Broth cultures of *Streptococci* from a fatal case of erysipelas are incubated for three weeks. They are then inoculated with *Bacillus pro-*

digiosus and reincubated for ten days. The bacteria are then killed by heat at 60° C. for one hour. The medicinal product consists of the resultant broth culture of dead bacteria and their toxins. Treatment consists in the hypodermic injection of appropriate amounts of this material, either subcutaneously or into the tumor itself. In the hands of the writer in a limited number of cases the results have been uniformly disappointing, while the desired reactions have, from the patients' standpoint, at least, been literally fearsome. Not a few cases are recorded of its highly successful use, but in spite of these it has thus far failed to convince many of its efficiency. Probably Coley has himself given or directed the treatment in more cases than all others combined. He has recently expressed his conclusions to Park, who, in his book upon "Pathogenic Micro-organisms," writes as follows: "Whenever, as at present, there is such a variance in the end results of different workers, it is always the wiser plan to withhold judgment until more definite knowledge is obtained."

Leaving, then, the empirical use of streptococcic toxin in therapeutics, we now approach its attempted administration for the cure of disease, based upon well-known but imperfectly understood facts. In other words, we attempt deliberately to increase the resistance of the individual to the organism. This we call immunity.

IMMUNIZATION

As in other forms of immunity, so here we have two varieties, active and passive. The former presupposes some activity on the part of the body in producing the increased resistance; in the latter the body is merely a passive receptor or container of something introduced from without to render it immune.

The classic example of active immunity is that following smallpox vaccination; of passive immunity, the use of diphtheria antitoxin. Without entering into the theoretical considerations, let us consider these two forms of immunization as they apply to the *Streptococcus*.

Passive Immunization.—Following the introduction by Behring of diphtheria antitoxin came the hope that in other diseases similar efficient agents might be discovered. Antisera of many varieties were advanced for divers conditions. The final result is known to all. With the probable exception of tetanus, it was soon found that immunity could not be as uniformly produced, nor could results com-

parable be attained in other diseases. Tetanus most nearly came to a satisfactory solution, and to-day antitetanic serum is, in the belief of the writer, the most rational treatment for the disease. It will be noted that these two diseases are characterized by the production of extracellular toxins. *Streptococci,* on the contrary, produce toxins of both the intracellular and the extracellular type. For reasons probably but imperfectly understood, the production of antitoxin or antiserum is much less satisfactory under these conditions. Antistreptococcic serum is now placed on the market by several pharmaceutical firms, and in a certain percentage of cases is used with undoubtedly good results. The disadvantage is that it is a serum able to immunize against but one or a few strains of *Streptococci,* while, if the patient is suffering from some other strain, its administration is ineffectual. We have seen cases, however, apparently almost dead, so far gone as to render response to vaccines practically impossible, show renewed vigor and start convalescence following the use of such an injection.

A case showing the interrelation of this serum and vaccines may be cited at this point, as it illustrates the usefulness of the two remedies, each in its proper sphere.

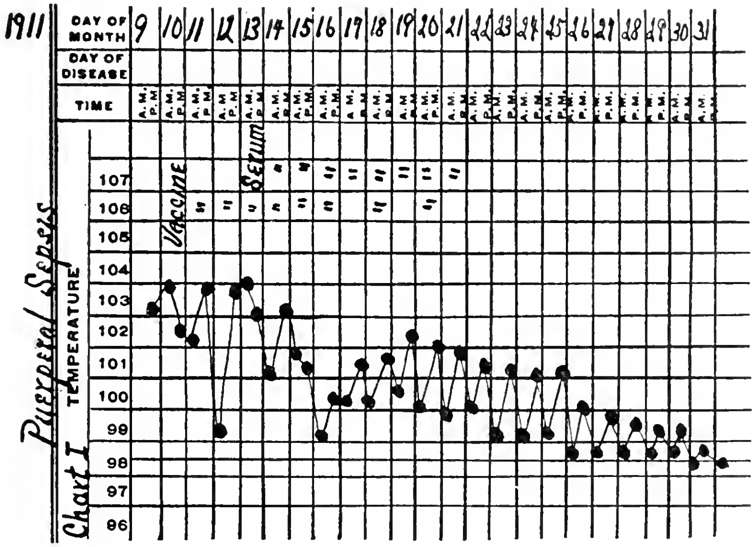
Mrs. A. Puerperal sepsis. About four days *post partum* she suffered a severe chill with rapid rise of temperature to 104° F., with the various allied symptoms of sepsis. Cultures from the uterine cavity showed *streptococci* in large numbers. The patient was brought to the hospital and vaccines were used. These proved to be without apparent benefit, the woman being very critically ill and without power in herself to manufacture antibodies. Antistreptococcic serum was administered for two or three days, and this was followed by a gradual clinical improvement. As the condition somewhat cleared, it was thought that sufficient vitality might be present to respond to vaccines, as the serum seemed to have ceased its efficiency. Accordingly, autogenous vaccines were administered the second time, and now with distinctly beneficial results. Convalescence occurred in an uninterrupted manner. (See Chart I.)

The case seems to illustrate the spheres of activity of the two preparations, sera and vaccines. The former are of great value when there is no reactive ability of the body present; the latter when such ability is present even to a slight extent.

If it were possible to isolate the particular strain of *Streptococcus,* and from this produce the proper animal antisera, it would be the ideal method, but the time required for the proper performance of such a preparation is, of course, entirely prohibitive.

To recaptitulate, then, antistreptococcic serum is often used with most gratifying results, but in other cases, for reasons already stated, its employment is followed only by disappointment. Passive immunization is certainly possible in a distinct percentage of cases of streptococcic infection, but just what the percentage is cannot as yet be definitely stated.

Active Immunization.—Differing from the passive form, the body may be made actively immune to streptococcic infection in probably a large percentage of cases when such attempted immunization is carefully performed. It is fully realized that in making such a state-



ment we are at variance with many other workers, who claim but little from such attempts. It is made, however, after about five years' continuous and rather extensive hospital experience, and is, we believe, based upon demonstrable facts. As there is such a variance of opinion, it seems advisable to describe in detail the various steps followed in the technique.

Almost without exception, the vaccines made have been cultivated upon human blood agar incubated at 37° C. for about twelve to eighteen hours. By human blood agar is meant ordinary agar or glycerine-glucose agar prepared in slanted tubes, upon the surface of which one or two drops of sterile human blood are deposited just

prior to inoculation. Vaccines are made from the original culture and from the first, or occasionally from the second, subculture. Cultures further away from the human are not as desirable, as they probably begin to lose their virulence. It is essential that much care be exercised in picking out individual colonies of *Streptococci* in cases of mixed infection, and at times dilution cultures are necessary. After a suitable growth has been obtained it is carefully washed off with a two-tenths per cent. solution of lysol made with normal saline. The chains are broken up as much as possible by shaking the tubes containing the emulsion, and the preparation is standardized by mixing equal amounts of the fluid and normal blood and estimating the ratio between disks and bacteria. Dilution to any desired extent can then be made. The material is then bottled and placed in a drying oven with double, water-filled walls at about 62° C. for from twenty minutes to half an hour.

Autogenous vaccines are always preferred, but stock preparations made as above have in our hands given much satisfaction in many cases where time or a mixed infection rendered the autogenous ones impossible. Such stock vaccines consist of a mixture of material from a number of different sources. The question next arises, in what classes of cases are vaccines to be recommended? These will be taken up in detail, each accompanied by one or two illustrative cases, taken somewhat at random from the records of those personally treated.

CARBUNCLE

The condition to which the name carbuncle is applied is one of all grades of severity. By some spoken of as an "overgrown boil," it is usually characterized by multiple points of opening. In the pus will usually be found both *Streptococci* and *Staphylococci*. The treatment will be varied, depending upon the stage of the lesion and the condition of the patient. If the area involved is extensive, if the drainage is poor, if, accordingly, pus is accumulating in abundance, surgical intervention should be first employed in order to remove the focus of toxic absorption, and this should be followed by autogenous vaccines as soon as they can be prepared.

If, on the contrary, there is adequate exit for the pus, and if the carbuncle is not massive, vaccines in association with careful dressing and antiseptic washes will very often be all the treatment required.

An illustration of each of these conditions happens to be at the present time under the observation of the writer.

Mr. H. was admitted to the Massachusetts Homœopathic Hospital with an extensive carbuncle on the back of the neck. Several openings were found with wide burrowing of pus, involving an area irregularly six inches in diameter. An extensive crucial incision was made, exposing much pus and necrotic tissue. For about ten days the condition remained practically stationary. Then some burrowing recommenced. The incision was extended and vaccines were begun. The pain, before this a considerable factor, rapidly disappeared, the gangrenous parts were sloughed off, and the wound began to granulate in with considerable rapidity.

It seems probable that if the patient had applied for immediate treatment and if vaccines had been used at an earlier date, the final convalescence would have been materially hastened and probably the course of the disease considerably shortened.

As illustrating this earlier application of vaccines the following case may be cited:

Mr. R. has been the victim of recurrent abscesses on arms, legs, and body. When first seen he had on the back of his head a carbuncle measuring, with the induration surrounding, about two and one-half inches in diameter. In the centre was one large opening, surrounded by seven smaller ones, from all of which pus was freely exuding. The patient says the condition began about five days ago, and has been steadily becoming worse since. It not only causes much local discomfort, but the general physical condition is disturbed by the toxæmia, giving rise to malaise, headache, and general weakness. It was decided to try vaccines without surgery. The carbuncle was washed daily with peroxide and covered with dry sterile gauze. Vaccines were given in amounts of ten million *Streptococci* and one hundred million *Staphylococci* every second day for ten days. The extension of the process ceased the following day and the dead tissue was rapidly discharged. In a week there was merely a small scab, and in ten days from the first treatment he was entirely well.

ERYSIPELAS

There is quite an unanimity of opinion concerning the efficiency of vaccines in the treatment of this disease. Ross, of Toronto, who has probably reported more cases than any other one person, is very optimistic about them. From personal experience, obtained from a series of about thirty cases, it has been strongly impressed upon the writer that in vaccines we have a very important means of combating the disease. It is fully appreciated that erysipelas, like pneumonia, is very prone to sudden changes for better or for worse, even when

uninfluenced by any medication, and that any deductions concerning the value of such treatment must be made with extreme caution. So frequently has it happened, however, that clinical improvement began soon after the use of vaccines, that it seems scarcely possible to conceive it to be a coincidence every time.

The usual case as it occurs is somewhat as follows: A patient in some way becomes infected. There is a rather sudden elevation of temperature to 103° F. to 105° F., possibly preceded by a chill. The part affected shows the usual bright erythema with or without the vesicular formation. The erysipelatous area rather rapidly extends, and with this may come delirium or other evidence of severe toxæmia. At the earliest moment possible after the diagnosis has been made a stock vaccine of *Streptococcus* is given, usually about ten million. This is repeated daily at first, then gradually at longer intervals, the autogenous preparation being used whenever obtainable. Usually, after the first or the second injection, the process ceases to extend, and there is distinct clinical improvement even before the temperature chart shows a beginning fall. Sometimes the temperature falls by crisis, sometimes by lysis. Not infrequently the patients report a symptomatic improvement within a few hours after the first injection.

Of particular interest has been the treatment of several cases that have been subject to recurrent, periodic attacks of the disease. Here, without exception, the attack in which vaccines have been received has been shorter and less severe than any previous ones. Also, none of these recurrent cases has as yet suffered from further attacks after the one in which the vaccine was used.

Several patients subject to such recurrent attacks have been treated during a period of health, and in none of these has the disease later appeared.

From the standpoint of mortality but one case in the series now being reported proved fatal. This one was a young man suffering from acute lymphatic leukæmia who in some way became infected. His case proved to be rapidly fatal, uninfluenced by vaccines. It is supposable that on account of his profound systemic disease he was entirely prevented from reacting in the manner that is the *sine qua non* of the sucessful immunizator.

In the ordinary mild case of erysipelas almost any physician may successfully administer the vaccines, but this is done preferably

after consulting with some one of experience in the use of this method of treatment.

The more critical the case, however, the greater is the need for the immunizator at least to see the case at first and often to follow the treatment personally, because so much depends upon judgment of the particular case. Incidentally the above statements will apply to all forms of streptococcic infection and then treatment with vaccines.

It seems safe to say then:

1. That vaccines tend toward arresting the extension of erysipelas.

2. That they tend to shorten its course.

3. That they tend to mitigate the clinical symptoms.

4. That they tend to prevent recurrence when used either during an attack or following one.

5. That they are safe and useful adjuvants, and as such deserve an important place in the routine treatment of the disease.

Two illustrative cases may be given:

Miss C., aged 25 years, was admitted to Massachusetts Homœopathic Hospital with severe infection of the face, both eyes closed, and a rapidly-spreading area of inflammation reaching to both ears. The following day the extension of the inflammation had ceased and the symptomatic indications were somewhat ameliorated. The second day saw almost complete disappearance of the pain and discomfort. The temperature went to normal by crisis and convalescence was uneventful. (See Chart II.)

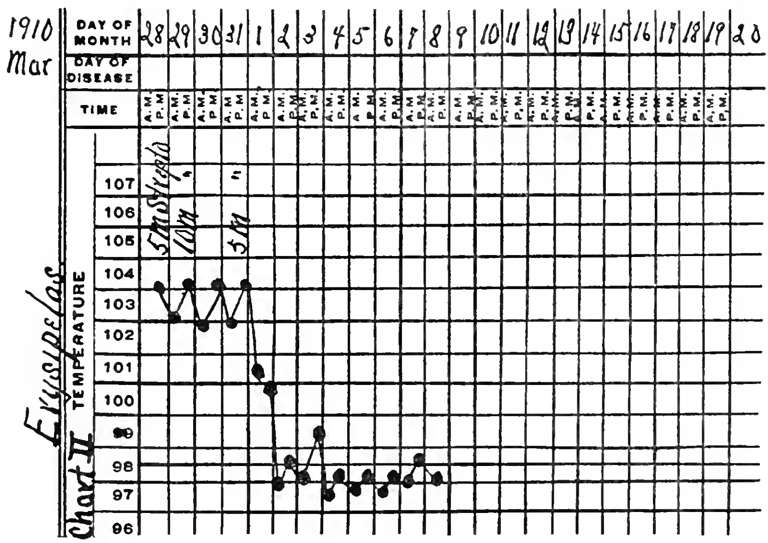
Mrs. Y., age about 65 years, was admitted to Massachusetts Homœopathic Hospital for a chronic valvular cardiac lesion of such severity that she could scarcely lie in bed with comfort, and often slept sitting up. An erysipelatous patch first appeared on the nose, and from this point rather rapidly extended to the cheeks and both eyelids. A low muttering delirium followed with twitching and with very poor heart action. Vaccines were given daily for four days, with apparently beneficial results. The area of skin involved gradually increased in size till after the second inoculation, when it began to subside. There was a gradual decline of all symptoms until the temperature reached normal. The period of convalescence was unmarred by any unusual recurrence. (See Chart III.)

PUERPERAL SEPSIS

As has already been stated elsewhere by the writer, the term puerperal sepsis is used to include several rather varied conditions. Any septic condition of the puerperium, from the slight cervical infections to the severe and critical post-partum septicæmia, may be here included. The infecting organism is, in the great majority of cases, the *Streptococcus*. Obtaining access to the uterine cavity, it seems to

find conditions favorable for development, first thriving in the endometrium, then penetrating into the myometrium, from whence it may pass by direct channels to the peritoneum or be carried by the blood and lymph currents to various parts of the body. In its earlier manifestations it is strictly a localized disease, but comparatively soon it becomes a general one.

From the standpoint of actual practice as well from that of theory, therapeutic hopes from vaccines are much greater when the condition is situated in some one more or less circumscribed space than when it is widely scattered throughout the organism. The



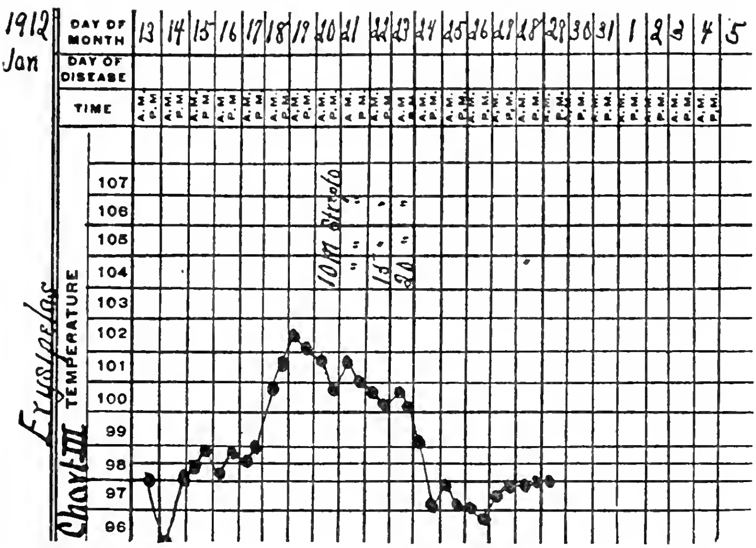
writer has elsewhere reported a series of fifty cases of this disease, the results of which have confirmed him in the belief that in vaccines will be found a valuable adjuvant to the regularly-accepted methods of treatment.

These and several cases treated since have all received stock polyvalent streptococcic vaccine as soon as the cases were recognized, and later, whenever possible, autogenous preparations have followed. Dosage has usually consisted of one or two millions repeated daily and with gradually-increasing intervals as convalescence took place.

Of the series of fifty, seven were practically moribund when

first seen and did not respond in any demonstrable way to treatment. Of the forty-three remaining, forty-one recovered, and two died.

Here, as in erysipelas, it is recognized that sudden variations in the course of the disease are frequent and that deductions must accordingly be made with care. Nevertheless, so frequently the sense of well-being after the treatment has been noted, and so uniformly has the condition progressed to a favorable termination where in the usual course of events it was not expected so to do, that it seems strongly probable that vaccines have been influential in bringing it

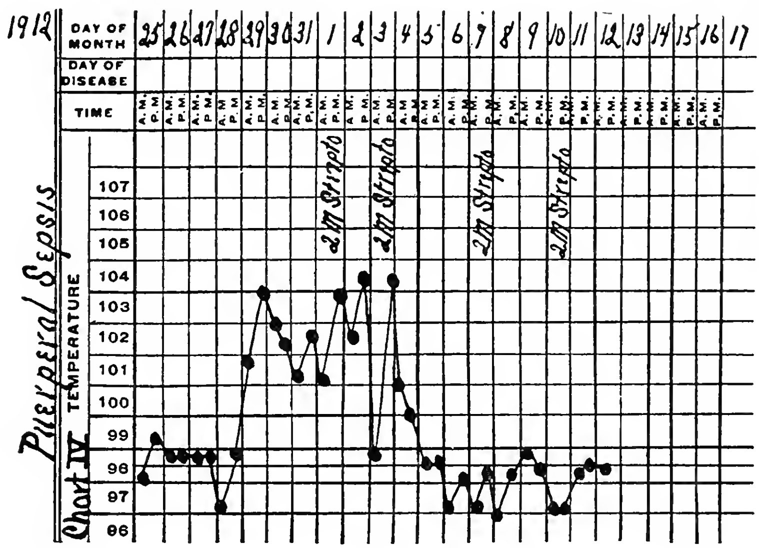


about. Merely in illustration of what has been done in this connection, two further cases will be given in brief.

Case I. Mrs. A. had slow prolonged labor, the pains persisting five days without effect. Labor was finally terminated by the application of forceps on December 26th. On December 29th a severe chill occurred, followed by a sudden elevation of temperature, with severe headache and backache. Two days later a culture from the uterine cavity showed *Streptococci* as the exclusive bacterial invaders. The blood at this time showed a marked inflammatory leucocytosis. On January 1st vaccines were begun, and were repeated on the 3d. This was followed by a fall of the temperature to normal by crisis, with a correspondingly gratifying subsidence of all symptoms. Convalescence was rapid. (See Chart IV.)

Case II. Mrs. B. was a primipara about twenty-eight years of age, and had been delivered without instruments on March 12, 1910. A slight vaginal tear

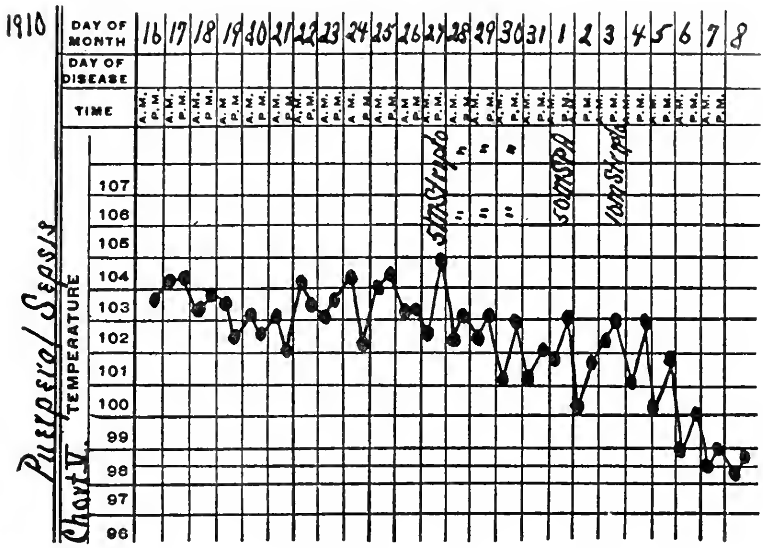
was the only apparent injury. About four days later the patient had a chill with elevation of temperature. This recurred daily and became steadily worse. On March 26th a consultation with several other physicians resulted in the expressed opinion that the condition was very critical. On March 27th she was seen by the writer. At that time the blood was examined on the spot, showing a marked inflammatory leucocytosis. Smears taken from the uterus showed *Streptococci.* Upon the strength of the above a polyvalent streptococcic vaccine was immediately administered and autogenous ones were later prepared. The result was most gratifying. In three days the chills had entirely ceased and a condition that had been steadily becoming worse was transformed into a rapidly improving one. (See Chart V.)



SEPTIC WOUNDS

In one way somewhat analogous to puerperal sepsis is the vaccine treatment of septic wounds due to streptococcic infection. As is well known, these cases are often cryptogenetic, starting possibly from some unknown or overlooked local lesion; or they may follow accidental punctures at septic surgical operations. Many of these have come to our attention. When first seen there is usually an insignificant wound surrounded by an extensive area of infiltration and swelling that is intensely sensitive. From this are found hard red streaks, the lymphatics, extending up toward the body, with frequent enlargement and sensitiveness of the lymph-nodes in the vicinity. This is

accompanied by general symptoms of toxic absorption, elevated temperature, rapid pulse, headache, malaise, and sometimes distinct chills. The routine method of treatment has consisted in incisions involving the area. From this, pus sometimes comes, at other times none is found. Then, depending upon the virulence of the bacteria and the degree of immunity of the patient, the condition either subsides or progresses. In the latter case further incision in other locations becomes necessary, until often there is either a prolonged duration, or death.



From our personal experience we believe the following conclusions are well founded:

1. Vaccines will not infrequently render surgical intervention unnecessary. Such cases should be most carefully watched, however, preferably in a hospital.

2. They tend to increase strongly the degree of immunity and to lessen the extent of the required incision, as well as reduce the need of later ones.

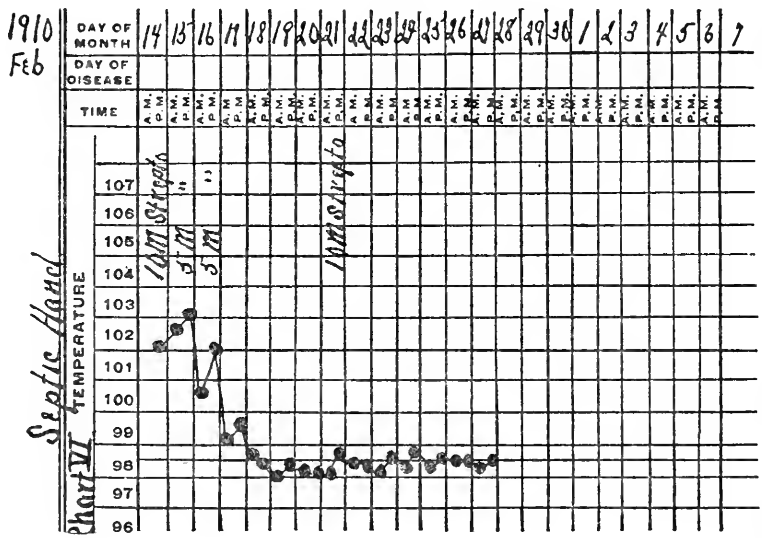
3. They tend to localize a spreading infection.

4. They hasten the stage of convalescence.

The following illustrative cases may be cited:

CASE I. Dr. X., while operating upon a virulent streptococcic infection two or three days previous, became infected by a needle prick. The finger and entire hand began to swell rapidly, with well-marked red streaks, extending up the arm, and enlarged and tender axillary lymph-nodes. Operation was decided upon. He decided to wait another day, continuing hot applications, and to try vaccines. A stock streptococcic vaccine was given as indicated on the accompanying chart. The next day the red streaks had disappeared, the following day the swelling of the hand had largely subsided, and the third day he went home.

CASE II. Mr. Y., a club man, infected his foot from a corn. Foot began to swell, and for two nights prior to admission to the hospital he could not sleep on account of the pain, that was not relieved by hot applications. When seen, the dorsum of the foot was swollen and œdematous, with some redness



in streaks up the leg. Hot compresses were continued and stock vaccines were given at about 5 P.M. He required morphine suppositories during the night for the relief from pain. In 24 hours the swelling grew less, and he slept nearly all of the following night without narcotics, and in four days was at home again.

CASE III. Mr. L., a medical student, became infected with *Streptococci* while working in the bacteriological laboratory. From the local site there was a rapid spread of the disease to the back of the hand and the wrist, the red streaks extending up the arm to the axilla, with enlargement of the lymph-nodes at that point. Temperature 102° to 103° F. Following the administration of vaccine and hot compresses all symptoms steadily ameliorated. The day that the temperature reached normal a small fluctuating area on the back of the hand was opened and pus was evacuated.

In addition to such forms of infection, a number of surgical wounds into which the *Streptococci* have accidentally gained access have apparently been much benefited by the treatment, clearing up more readily than others have usually done where no vaccines were used.

MENINGITIS

This is almost always secondary to primary lesion elsewhere. One case seemed to receive marked benefit from the treatment, and recovered. The others have all died, some possibly showing temporary reaction, but none any permanent benefit.

OTITIS MEDIA

Without question, vaccines have exercised a beneficent action upon several cases of this disease, both by hastening the disappearance of pus and by apparently decreasing or removing the danger of mastoid complication. As a postoperative treatment of mastoiditis it has also proved to be of service.

ACCESSORY NASAL SINUSES

Vaccine treatment of streptococcic infection of the accessory nasal sinuses has been more unsatisfactory than any other one department of the series of cases treated. Even here, however, some very gratifying results have been at times noted. The great difficulty seems to be that of adequate drainage and the replacement of the pus by serum of higher opsonic power. One of the better cases may be cited:

Mr. L., a letter-carrier, had suffered from frontal sinus infection for a number of years, periodic attacks occurring every week or so, with severe congestive headaches. An autogenous vaccine was used about twice a week for several weeks. The condition entirely disappeared and has now remained so for a period of nearly four years.

A somewhat similar case in a young lady was completely cured after local treatment had proved unavailing and operation was the only alternative. A larger number of such cases show an increased feeling of well-being and some local improvement. The improvement has been only too often temporary in these, the former trouble returning once the vaccines are discontinued.

TONSILLITIS AND BRONCHITIS

Far different from these are the results from cases of tonsillitis or bronchitis, acute or chronic. Many of the streptococcic anginas have been undoubtedly influenced in a favorable manner.

Mr. N. was subject to tonsillitis and pharyngitis for years without any very definite cause. Cultures showed *Streptococci* in pure culture. Vaccines have already made him better than for a considerable time, and the benefit still continues.

A case now under treatment will demonstrate the advantages thus fully treated with vaccines after the more common methods had been tried without avail.

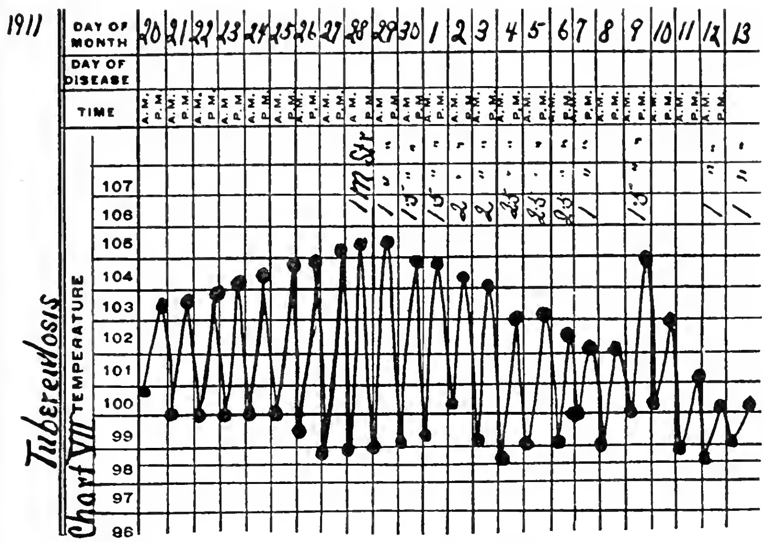
TUBERCULOSIS

Of particular interest is the use of these preparations in cases of pulmonary tuberculosis with a secondary streptococcic infection. While the more common form of such infection is the *Pneumococcus,* yet in not a few instances the *Streptococcus* is the troublesome invader. When such is found, properly-prepared autogenous vaccines are capable of reducing the fever, causing a decrease in the cough and expectoration, and giving a much better feeling of well-being, as manifested by increased appetite, gain in body weight, disappearance of night-sweats, and other allied symptoms.

A case now under treatment will demonstrate the advantages thus gained when there is a complication of empyema and pulmonary abscess formation.

A. B., a boy seven years old, about two years ago gave a positive cutaneous test for tuberculosis, and at that time had several enlarged cervical lymph-nodes. Under tuberculin (B. E.) they subsided in a few months. He was advised to live in the country, and accordingly the family moved to a large farm. Early in September he began to show a gradually-increasing fever, rapid pulse, and cough. Physical examination showed an area of dulness in the right lower lobe of the posterior lung. This persisted with increasing severity of symptoms. Diagnosis of empyema and pulmonary abscess was made. Aspiration gave negative results. An opening in the intercostal space gave a very little pus. Drainage was maintained with slight result. The condition steadily became worse, the evening temperature increasing to 104° F., 105° F., and finally to 105.4° F. The pulse was rapid and intermittent; the respirations rapid and labored. Blood showed a marked inflammatory leucocytosis of forty thousand. Cultures showed *Streptococci,* with *Pneumococci* and *Staphylococci.* A hopeless prognosis was given. Autogenous vaccines were used daily after two doses of stock had been given. The result may be seen in Chart VII. The temperature grad-

ually subsided, and at the same time the clinical symptoms improved slowly and steadily. About three weeks later, when the very hopeless aspect of the case had entirely changed, there came a sudden discharge of pus to the amount of several ounces. In this were found the bacilli of tuberculosis and *Streptococci*. Later the small opening was enlarged, and with the finger there could be felt a distinct opening into the adherent lung about five centimetres in diameter. At the time of writing, three months later, convalescence continues, slow and somewhat interrupted, but nevertheless sure. The morning temperature is normal, the afternoon 100° F., sometimes 101° F., and rarely 102° F. or higher. Respiration is normal, strength is increasing, appetite is good, and general condition is much improved.



This seems to be a definite illustration of the transformation of an apparently hopeless case, when all measures had proved unavailing, into one of apparent convalescence by the use of vaccines as the only new adjuvant. The future progress of the boy is being watched with much interest.

PERITONITIS

Several cases of general peritonitis following puerperal infection, pyosalpingitis, or appendicitis have received appropriate treatment following operations. While it cannot be definitely stated how much has been due to vaccines and how much to operation, yet it seems evident that the general resistance of the patient has been much increased, with a corresponding increase in the chance for ultimate

recovery. One case in particular comes to mind where, in a lady of about forty-five years, a very severe infection was discovered. All hopes of recovery were abandoned until after the administration of vaccines, when there was a very evident response that continued to ultimate recovery. The degree of immunity can certainly be stimulated in a very large number of such cases, but whether it can be raised sufficiently high to enable recovery to occur can only be determined by investigation of each individual case.

INFECTIONS OF THE URINARY TRACT

In these cases where there is a plain streptococcic infection without such complications as calculus, tumor, or other gross abnormality, much may be done. In discussing these lesions one case always comes to the mind of the writer.

A lady about thirty-five years old, fond of society and always anxious to be performing her social duties, developed, from some unrecognized cause, a troublesome cystitis. The urine contained an abundance of pus. So severe were the symptoms that she was practically incapacitated for her usual vocations. An operation was finally performed, there being an idea that some ovarian or other tumor might be pressing upon the bladder. This gave no benefit. The condition continued for seven years. A streptococcic infection being found, vaccines were tried, and the patient treated in addition with rest in bed and ual improvement was noted, and at present, after about three months, she is three months she was up and able to attend to her usual affairs without difficulty, something previously impossible for several years.

ENDOMETRITIS

The writer has seldom found cases of endometritis associated with the *Streptococcus* in pure culture. One such case is at present under observation.

The patient, in whose case no history of gonorrhœa was obtainable, had had for several years a profuse purulent uterine discharge that had been controlled by no means of treatment, operation having been refused. Autogenous streptococcic vaccine was prepared and used at intervals of about seven days. Gradual improvement was noted, and at present, after about three months, she is better than she has been for years and has very little, if any, discharge.

In addition to the wide field for streptococcic vaccines in therapeutics, there also is one, by no means insignificant, in prophylaxis. One section of this may be explained by an illustrative case:

Mrs. M., by no means robust or strong, came to the hospital to prepare for an operation for a fibroid tumor. On account of personal interest in the case and the apparent lack of immunity to infection, should such occur, it was decided to give prophylactic injections of *Streptococci, Staphylococci* and colon bacillus. An abdominal operation was performed in a few days. Following this a quite large intramuscular hæmatoma appeared. Here, if anywhere, would seem to be ideal conditions for pus formation, once bacteria gained access. A secondary operation was fully expected by all for the purpose of cleaning out this focus. Three days following a little thin blood escaped from the wound and in this were found hæmolytic *Streptococci* in numbers, as well as *Staphylococci*. Two days later a small tube was inserted into the cavity and vaccines were given. A very small amount of pus appeared, and in about twelve days the cavity had entirely closed. This would seem to have been a case that under normal circumstances would suppurate freely, even if nothing worse should occur, which was very favorably influenced by the prophylactic vaccines.

Another sphere for prophylactic streptococcic vaccines seems to be scarlet fever. The writer has already reported elsewhere his results in immunizing nurses that have never had the disease and that are nursing scarlet fever cases. The accompanying table will give a summary of such. The results even in such a small series of cases are very suggestive. All of the nurses received a polyvalent vaccine made from cultures from the throats of scarlet fever patients. It is particularly instructive to note that, following this series, three nurses were immunized by polyvalent streptococcic vaccines made not from scarlet fever cases but from miscellaneous surgical infections, and that all three contracted the disease.

TABLE SHOWING EFFECT OF STREPTOCOCCUS IMMUNIZATION OF NURSES

Year	No. Non-Immune Nurses	Receiving Vaccine	Not Receiving Vaccine	Contracted Disease				
				Receiving Vaccine		Not Receiving Vaccine		In Favor of Vaccine
				No.	Per Cent.	No.	Per Cent.	Per Cent.
1910...........	21	10	11	1	10.0	2	18.0	8
1911...........	15	11	3*	0	0.0	3	100.0	100
	36	21	14*	1	2.7	5	35.7	31

* Incomplete immunization in one case.

Jour. A. M. A., Feb. 24, 1912.

Having thus taken up the various lines in which streptococcic preparations, either autogenous or stock, have been used with apparent

benefit, it is hoped that the reader may have obtained some adequate idea of their applicability. In the pursuance of the work failures have been repeatedly encountered, and in many instances no benefit has been noted. No attempt is made to prepare a brief for the method to the exclusion of others. It can be definitely stated, however, that never has any demonstrable harm followed the use of vaccines in any case, no matter how critical. As their use is urged usually as an adjuvant only, and not to replace other methods of treatment, and as no injurious action has been noted in the large series treated, it seems but fair to give to them still further investigation. By so doing it seems probable that the results will show a decided benefit from either autogenous or stock preparations, preferably the former, that mortality will be lessened, and that the results of streptococcic infection will be rendered much less severe.

FOOD—WHAT IT IS, AND WHAT IT SHOULD BE

BY W. O. OWEN, M. D.
WASHINGTON, D. C.

To believe the song of failures,
In a land where good men have won,
Is casting your lot with losers,
And doing what they have done.

To listen and learn from winners
Is winning yourself—their stake!
You need not fear the advice you hear,
But beware whose advice you take.

—BY CLIFFORD GREVE.

Do you realize that your mind grows with each new thought that you think? Whose mind regulates your ideas? Do you do your own thinking? Or do you allow some dead-and-gone man to do it for you? He is dead, you are here, alive, in the twentieth century, with new thoughts, new facts impinging on your mind every moment of your life. Think about it, and remember that each individual is master of his own mind, and that each one can control his own thought, and that it was only after suggestion had been piled on suggestion that the bad habit was formed of thinking that the individual was unable to control his own thought. One can always do that which one wishes to do when there are none to oppose.

Disease is only the disagreeable result which we feel in consequence of a conflict of interest between ourselves; that is, our physical bodies and some other living entity, one of the laws of existence being that all living bodies must consume other living bodies in order to continue to exist. The strongest and most fit always win the fight, with the survival of the fittest as a result.

We speak of disease as if it were an entity, as if it were an army attacking our person, and it almost always is, for there are three great causes of disease: vegetable, and animal parasitic life and accidents. There is another cause of disease which does not concern us here. The human being, the human body, would go from birth to

death painlessly and without discomfort could these four causes of disease be avoided—would pass from childhood to maturity, to procreation, and on to dissolution free from pain or discomfort.

The law of self-preservation, or race preservation (for race preservation is only a part of self-preservation), is that the greater the need of the function, the greater the pleasure of the individual in the exercise of the function. It is from this law in action that we are trained by our kinsfolk into the habits of our lives or appetites, from which we have the greater part of the pleasures of our lives.

We are taught as children to enjoy this or that natural function of our bodies; to eat and enjoy this or that beautiful food; this or that nice, palatable drink. Thus it is that our appetites are founded on and in our necessities, and those that love us, not realizing the limits of the body, drive these instruments of destruction home on us. All may be suppressed by mental action, those which pertain to the individual life being the most insistent, because the most necessary. This law of self-preservation is the never-ceasing instinct of all life which continues to exist on earth.

When God made man, He made a law of self-direction for the existence of man which I can best express by an allegory.

Man enters upon the circular plane of existence at the centre from a beginningless past and journeys to the circumference and goes over the edge to an endless future. On this journey, toward the north he will find endless joy and physical well-being; to the south endless sorrow and physical discomfort. He may go in any direction at his own volition. He generally goes northeast or northwest, very rarely south of the east and west line. His natural tendency is due north to happiness and physical comfort. Some, actuated by an unconscious fear-thought and a desire to improve the character of the mental action by the deliberate induction of physical discomfort, tend to go south of the east and west line. Health is the joy of life under normal and natural conditions.

FOOD—WHAT IS IT?

Food proper is that material which we eat and which goes to nourish our bodies and which supplies us with that energy with which we think and with which we move and have our being. All that we eat is not food in this sense, though, had we eaten it in a better way,

we might have converted it into food for our bodies. A large majority of people eat, not for the purpose of supplying food to the body, but for the well-understood purpose of gratifying the appetite with the joy of eating.

The law of self-preservation, Joy, the satisfaction given by the exercise of a function, results in a majority of the people eating far more than is for their best interest; in fact, results in many attacks of disease. I would not have you think that this is the direct cause. It is not; this excess food simply overworks and exhausts the body and thus allows the active cause of disease, plant or animal parasites, to get a foothold and to grow within our bodies and thus to produce that character of intoxication which we see and call disease.

This excess of food were indeed a small matter were it not for two factors:

1. The body being overloaded, the organs dealing with the elaboration and absorption of food when called on to functionate—that is, to elaborate and absorb—beyond their capacity do not produce the changes which they do under normal conditions of supply, and a poisoning results quite of the same general character as that produced by alcohol, opium, and cocaine.

2. This overload gives those organs of the body dealing with the removal of waste not only their normal work of removing the exhausted residue of the food supply and the waste of the body, but the further labor of ridding the body of this unexhausted, partly digested, fermenting mass, which under right conditions would have been food.

The tissues are undoubtedly damaged by contact with improperly digested, or undigested, food-materials which have been more or less prepared by previous action of plant or animal life for absorption by the human body. All food-materials have been previously acted on by vegetable life; we do not know where the interaction between animal and vegetable life begins or ends.

Being trained to find pleasure in eating, we little by little form the habit of eating at a definite hour of the day a definite amount of food of definite character of food-material. The nature of this habit depends upon the comfort and convenience of those whose duty it is to supply the food-material and those whose duty it is to see that the food is served and prepared properly.

This same joy of feeding which demands that we eat to supply

the body with food we use to gratify the senses, to occupy our time, to enable us to pass the time without *ennui.* Thus it is that we run the machine which we call the human body not at the normal capacity, not at the load for which it is constructed, but at its full-overload capacity, with all that it will carry. What wonder then that every little while we learn of some friend, some loved one, who has blown a fuse and is down and out; now and then the fuse carries and the motor burns out and our loved one is dead! How often we hear of some friend who is down with indigestion, an apoplexy, or is dead from some sudden attack due to an unknown cause!

How many of us remember that every time we take into our bodies a pint of fluid that it is a pint of weight, one pound? How many of us stop to remind ourselves that if we take into the body more than we pass out of the body we are certain to increase, by just that amount, in weight, and that if we cast off more than we take in that we are certain to lose in weight?

OVERLOAD

Our hurry in eating causes us to do two things: first, we put into the mouth too large a bulk, and, second, we hurry the food-mass out of the mouth. Thus it is that this larger bulk is not even properly prepared.

The mouth, with its taste-nerves and teeth, and its near neighbor the nose, with its smell-nerves, are among the important outposts of the body whose duty it is to challenge and question all that seek to be embodied. These sentinels have in many been bullied and hustled until now they are satisfied with a bare taste and only a sniff of the odor of the food-material as it is hurried along.

The proper preparation of the food in the mouth is an exceedingly important factor in the further elaboration of the food-material in the stomach and intestine. It is a great mistake to suppose that the saliva does not continue to act after the food-mass is in the stomach. It does. It is in these two mouth factors that a very large number of the disorders of digestion and nutrition have their origin.

The ordinary process of indigestion is about as follows: The mouth is filled to about three-quarters of its full capacity with food-material; this is then softened with water, tea, coffee, or milk, to bring out the "un-saliva-ed" taste of the material, the unearned taste,

and then long before the teeth have been able to disintegrate the mass, or the tongue to assist them to mix it properly with the saliva, the combined mass is hurried into the stomach. This continues until it is no longer possible to put more into this long-suffering organ. The stomach is unable to handle the mass properly, the juices cannot penetrate it, the stomach muscles are unable to handle and churn the mass. Bacteria and other forms of life have been driven into all parts of this material; in the stomach they find every condition favorable to their growth. Thus, they promptly not infrequently produce poisonous materials which are irritating and destructive to our bodies. We then have an intoxication which we do not enjoy and which we call an indigestion, and on top of this we add another meal *of food!*

How often do we see men and women who should know better, take at a single meal two or three pounds of solid material and three or four pounds of liquid material! What man is there reading this paper who has not time and yet again told of how heartily he had eaten at this or that feast until he could eat no more, how greatly he had enjoyed himself? Many times have I found myself change weight from four to six pounds within twenty-four hours.

The patent food artist constantly advertises and suggests to us that we eat just a little more, that his food is so much better than that we ordinarily can get, that its flavors and tastes are the finest ever, and in the same paper we find the advertisement of the patent medicine man with the beautiful thought that we can eat and enjoy any old amount of any old stuff, and then through his medicine escape from the results of our own imprudence. And this is the most innocent of these advertisements, for when our bodies are loaded with undigested, partly digested, fermenting masses, and we are heavy, sick, and miserable, we take one of the patented medicines and the poisoned food-mass is discharged from our bodies. Who, under such circumstances, can fail to feel better and to be better? Would it not have been best not to have taken this mass into the body? Would not the digestive organs have been better off with neither? When the discomfort of a drastic cathartic has passed and food-clinkers are removed, it is wonderful how good is the taste of food.

How constantly we see parents encouraging the children to eat more and more! Only a day or so since, a doctor friend of mine

entered one of our best Washington homes and there found one of the children stuffing himself with cakes and candy. After watching the child for some time he said to the mother, "Have you no better sense than to allow that?" and the reply he received was, "Why, doctor, I have a fine medicine here for indigestion to cure him if he gets sick." *This in the presence of the child.* What a training for that child! Remember this and do not do it yourself.

It is indeed a curious thing to see our women, who love us and desire for us only the very best, watch and endeavor in every way to see that each and every individual of us eats far more than we should. See with what loving care they study innumerable cook-books to find some new dish, or some new method to prepare an old dish; to find a new sauce, or a new irritant to stimulate our appetite, our habit hunger, or thirst, to further fill our overfull stomachs. The public press is full of articles calling upon us to make the pleasures of the table still greater. Everywhere we are met with the suggestion that we should eat more and yet more of this or that food on account of the flavors which it contains. Nowhere anything concerning the joy and pleasure to be had from the exquisite tastes and odors in all foods, but which are only due to and reach those who have earned them by the proper disintegration of the food-mass and a mixture with the juices of the salivary glands, and a keeping of it within the mouth long enough for the reactions upon which these flavors depend to take place.

There is no joy like to that given by a food flavor which has been earned. An earned hunger comes only to him whose body has been without a re-supply of food or water until there is a physiological need of a re-supply. Food flavors in all their beauties and subtleties come only to him who has a true hunger and earns this exquisite pleasure by a proper mouthing of his food.

Habit plays us many tricks. We all labor with the thought that we will be exhausted unless we get three meals a day. What a folly! How wrong! I know men who eat once a day, and that only after the day's work is done. I know one who is sixty-five years old, who can walk four miles in an hour; can turn a backward somersault; his food habit is once in twenty-four hours, often once in forty-eight hours; frequently he goes three or four days without food, oftentimes twenty-four hours without water. Our sufferings

from thirst and hunger are very largely our own suggestion, ably assisted by the fears of our loving friends. Were it not for our own fear-thoughts and suggestions added to by the patent medicine and food advertisements, fully two-thirds of medical practice would not exist, for the people would not be *so overfed, so overfull of undigested, half-digested* matter which requires the action of medicines to remove it from the body.

Vis medicatrix naturæ, the curative forces of Nature, if allowed to act on the body, in nearly all cases would produce a cure. When one sees, however, the thousand and one things which human beings will do to themselves under the plea of adding to their comfort or well-being, sees them destroy the one and injure the other, one ceases to wonder why we must still have the doctor to guide us from these easily-prevented injuries.

The great work of discarding the worn-out, the used-up material, and replacing it by new material, goes on continuously within our bodies and we are not aware of it. It is performed by and under the control of our instinctive minds, by our unconscious selves. The first duty of all self-respecting individuals is to see that the body is duly and properly nourished, to see that the body has on hand for external expression a supply of energy at least equal to the power of the body to store it.

Rich, highly-flavored dishes are an ever-present source of danger from the temptation which they offer to excess by means of the unearned pleasure they give in the eating. To starve, and lower in this way one's life energy, is quite as dangerous to the individual as overfeeding, but it terminates, as a rule, less suddenly and is more easy to correct. Here, as in all other human procedures, the right place is midway between the two excesses. Human bodies must have the right amount of food if they are to functionate at their best. I think that one should be an epicure for the beautiful flavors which we can earn from any and all of the ordinary foods rather than for the unearned flavors brought out by the trained cook.

There is a world of difference between appetite and hunger or thirst. Hunger and thirst are natural cries of the tissues for a supply of material from which they may be able to generate new energy for the use of the body. Appetite is the creature of man's own suggestion, constantly repeated until it becomes almost a demand, and, in

some cases where a habit is formed, an imperative one. Hunger and thirst are the beautiful tints of a young natural human face; appetite is the coloring we see painted on an unhealthy face.

Explaining these differences to the average human mind is like explaining color to the blind or sound to the deaf. Hunger and thirst in no way resemble the feeling of emptiness, goneness, distress, faintness, dry tongue and throat which are so constantly referred to by people to express the feeling of thirst or hunger. It is a lesson in dietetics to hear the ordinary man describe his desire to gratify his life habit, calling it hunger. He will talk about his sensations by the hour, never once realizing that he is describing and creating his appetite, and that hunger is quite another thing. These cravings, goneness, faintness, and dizziness are the mark of habit of appetite, and have nothing in common with hunger or thirst, both of which have only one method of expression—the increased delight, because of the increased delicacy of the flavors which we find in feeding or drinking. Habit and appetite are the result of repeating the same action and thought over and again.

There is a world of delight in holding food in the mouth and allowing it to soften and dissolve; there is a world of most beautiful flavor and odor in even the most common foodstuff, when the saliva is allowed to dissolve and act upon it in the mouth. Men should so eat as to get the greatest possible pleasure from their food and drink. He that does not, fails to do his duty to the public or himself. The public has a right to his best brain, and he cannot give that when his body is not properly nourished. This only comes with that unconscious swallowing which goes with food that has been properly mouthed, while conscious swallowing goes with those masses which are insoluble and cannot be, or have not been, rightly disintegrated by the teeth.

Food is not the number of calories which you swallow in food-material, but the number which you use in producing energy with which to think and have your being. Man would be a stronger, better machine with less foodstuff, were the material better cared for by the mouth.

I often find myself wishing that civilization could, or rather would, bring itself to have among the table service, to be placed by the side of each plate, a deep, small jar for the purpose of receiving the

insoluble and tougher parts of the food-mass that neither the stomach nor intestines can handle with impunity, so that it might soon become the common feeling of all the people that one of the most indecent things that human beings could do would be to fail to remove from the mouth and put into the discard jar all material which the tongue, teeth, or mouth finds not proper to put into the stomach.

We do not eat naturally, we do not drink naturally, nor even think naturally. There is a beautiful prayer in the service of the Episcopal Church which to-day has a very different meaning to me than it had formerly: *"We have done those things which we ought not to have done, and we have left undone those things which we ought to have done, and there is no health in us."* I would say *and our health is not what it ought to be.*

Few people use the mouth and teeth as they should when eating. When one tears the food-material with the teeth and mixes it with the saliva, as should be done, and allows time for the reactions to take place and to produce the chemical changes proper to it, one is amazed at the wonderful and the beautiful flavors which may be developed from even the most common food.

The force of habit is shown in a most astonishing way to one who has once enjoyed these pleasures when he suddenly finds himself crowding his mouth with food and bolting it down, softened with water, all unchewed, just as if he were the proud possessor of a crop and a gizzard, like the bird's, into which he might pass his food to be softened and ground up with the digestive juices.

It should never be forgotten that the mouth cavity, with its teeth, its salivary glands, taste- and other nerves, and the nose, with its nerves for odors, each has, indeed, to serve a definite function in the digestive process, and that a definite part of this is to warn the stomach what it may expect to receive from the mouth and the condition in which it may expect to receive it. The stomach must indeed be warned what to expect, so that it may prepare to receive it with due and proper ceremony.

There are three pairs of large glands connected with the salivary function, besides many small ones, and when the food has been properly prepared in the mouth it is a tasteless liquid, not to others but to the individual mouth at the time, a liquid from which the taste has gone and which flows down the throat in an unconscious swallow-

ing. The first function of the salivary glands is to secrete fluid to soften the food, to bring out the odors and flavors of the food so that the nerves of taste and smell shall stimulate the glands to a different secretion fitted to the material which is to be acted upon. When you deprive the nerves of taste and smell of these and substitute those due to a solution made elsewhere outside of the body, the food will not be acted on in the mouth as it should be, and the result is that the organs of absorption are given improperly elaborated material. This is poured into the blood-stream, the tissues use it as best they may, but the result is not the best, and the body does not functionate in the normal way, and the individual man has been deprived of one of the greatest joys of life, the pleasure of food properly eaten.

Our bodies are like our body politic: each part has been differentiated to special work. The result is that we have gradually come to the conclusion that we may substitute a grinding machine for teeth, that we may replace the flavors generated by other forms of life for those created out of these by the action of our own tissues. We can use many of them, but not with that benefit which comes from a right mixture of them with the fluids of our bodies, and which taste and smell indicate to us by ceasing to give us further pleasure with the food that happens to be in the mouth when the process is complete.

The taste-nerves, as soon as the food is dissolved in the water of the saliva or other liquid, convey the information of the fact that a definite character of food is in the mouth, while the odors ascending through the backdoor add to the story, the two giving rise to the delights of the table, for it is this combination of taste and odor which we so enjoy in eating. It is the combination resulting from the impressions of weight, texture, odor, taste, heat, cold, etc., that are conveyed to the brain, the mind, the ego, which in turn sends out through the nerves those impulses which cause the glands to secrete quite different fluids for each food, with quite different chemical attributes, depending on the information conveyed by the incoming nerves, even if we cannot demonstrate it with our test-tubes. I like to think of it in this way. The mouth receives the food, and, with the assistance of the nerves of common sensation, taste, and odor, analyzes it. The brain receives and co-ordinates the information, and wires the

stomach and other organs of elaboration what they must make preparation to receive and how to prepare. I like often to think of the body feeding as if it were a community of individuals in which the eyes, seeing food, cry out, "I see food"; the muscles say, "Show me where"; and when they get close the nose says, "Smells good, it is all right." The eyes and nose guiding the muscles take the body to the food and it is seized and conveyed to the mouth, which meanwhile is calling out, "Put it into me and allow me to prepare it for the common use." The whole body rejoices in the destruction of another living entity, because by so doing it has secured further progress along the lines laid down by the Creator of all for its race preservation.

Man originally had to gather his foodstuff living as it happened to grow, or to feed. Long training has taught him to conserve his energy, and grow and keep his food supply near at hand; has taught him to prepare it and in many ways to save him the labor of finding or chasing it.

We have a limited amount of desire for food, which may be gratified only through taste and smell. This may be done either in a normal or an abnormal way. The normal is to carefully tear the food apart with the teeth, mixing it meanwhile with the saliva, which acting on these materials gives rise to far more beautiful tastes and odors than those which are due to unacted-on flavors and odors, and there results a far greater pleasure in the eating, a greater satisfaction after the eating, with a happier mind and more comfortable body, the direct result of a better elaboration of food. Much less food will be eaten, hunger and thirst will be better gratified than before, our appetites will not be perverted by the actions of high flavors and irritants.

There are two classes of food habits among civilized men—those who eat too much and those who do not eat enough—suggestion forming a large part of these habits, just as it does in every other habitual action.

I divide food habits into four classes:

1. Those who eat only that amount of food which the body can handle to its own best advantage. (I have never seen such an individual.)

2. Those who eat only the amount of food which the body can

handle without serious damage to its organization. In this class there are a few women and men, thin, spare individuals of abstemious food habit, with great energy and whose absorptive and excretory powers are great.

3. Those who eat for the great pleasure which it gives them, but not heavy feeders, though verging on that class. To the best of this class belong those well-fed, well-kept, plump people who are strong and full of energy, but whose excretory powers are not equal to those of the second class.

4. To this class belong those who eat all that they want, and drink to the same good measure; they seem to live for the purpose of drinking and eating. They are large, soft, loose-tissued people who seem to find it difficult to move, or exercise the muscles in any way, or to think; they regard themselves as victims of an unfortunate bodily inheritance which they are unable to resist, that no matter what they do they will take on fat and water; and so they will, for they never fail to take in all that they find lying around if it is fit to chew.

Fat and water stored up in the tissues do not represent energy for use in the body, but they do represent the scale in a boiler, and do prevent the fuel energy introduced with the food from reaching the tissues whenever they reach beyond a very small amount. Were this fat and water an exhibit of strength and endurance, a storehouse of energy, the athletic field would be full of these round, full-bodied individuals. We all know who it is that wins in the contest of endurance.

To my personal mind, the blood-cell action, as it exists in the body, is as if the cells were a pack of wolves, wild, hungry, with but one single thought, "Where will I find something that I may eat?" this being the thought and actuating motive of every movement. Let some unlucky animal, no matter of what genus, no matter of what size, fall suddenly over some cliff, turn suddenly some point of the bluff, and find himself in the midst of a sleeping pack of these wild, hungry animals. From quiet sleeping forms, the very first feeding growl that escapes the throat of any single member of the pack converts every living form into an activity that is difficult for civilized man to conceive, each and every one with every energy bent to obtain for its own sustenance some small part of the living

entity which has strayed their way. These same wolves will eat one another when they lack for other food; they choose some one individual, double teams on him, and divide the portion of life which he held among themselves.

Man has found the fox a destructive animal to his poultry, with the result that he trains dogs to chase these animals. Civilization has at last so far destroyed the fox that it is no longer a necessity to chase the animal, but man, a creature of habit, likes to renew his former pleasures; he therefore raises foxes, keeps them in good order, or catches one, keeps him in *good order* until the chase may be made ready. He then takes to the field his pack of trained fox dogs, which have meanwhile been kept confined in kennels, and fed regularly with cooked food. Both the chased and the chasers are accustomed to meal hours, to cooked food carefully prepared. The natural man, the man who feeds himself a proper amount of food, properly prepared, who cares for his mental action with painstaking activity, may liken the cells of his body to this pack of sleeping wolves when the body is invaded by some foreign life. But the modern man with his fat- and water-laden tissues may compare his cells to the cooked-food-regular-meal-fox-hounds, trained to chase other animals as an amusement, not for food, not that they may continue to exist, but for pleasure. Once more we see that which was given us that we might continue to exist converted into the means of our destruction.

Upon the condition of your circulating fluid, your blood, depends your bodily comfort. By care and attention to your food you can keep it in good condition; by improper care or lack of attention you supply it with improper material. Then, why scold when you feel badly, the result of your own folly?

Man comes into existence how? He does not have a conscious image of any of the processes of formation nor of the birth into this world. He goes out of this world how? I do not think that he has any consciousness of his departure. I have watched many die, and at the last there is quiet, peace. Our habit is such that we fear all sorts of evil, look for all manner of ill. From birth to death we are never-ceasingly admonished by friend and foe to dread this or that; that such and such will cause pain and distress. What wonder then that we feel pain! What wonder that we dread pain! We suggest it to our loved ones; we suggest it to those we hate, and we suggest

it to ourselves in every waking moment. What wonder then that some men feel that we create our own diseases with our own thoughts —certainly we image the pain, the disease, before we suffer from it! We always have the picture suggested to us by our doctors and our friends: the two are always together.

I do indeed believe that, could we be trained through life along the right lines, we would go to death, not with fear of the unknown, not with dread of the future, but with a sense of task fulfilled, with all the pleasure of a joyous anticipation of a happy, pleasant existence yet to come. Our friends would be by us at the last conscious moments contentedly, pleasantly wishing us a happy journey, asking us to prepare the way for them, so that they may find it easy to reach us when they too join the great majority. So far we have been unable to convert the process of birth into one of pain for the child, though it is one of fear for the mother.

I close with two quotations from doctor friends. Doctor Folkmar gives me this: "Proper eating is one solution of the problems of living. It means a saving on the butcher's bill. It means a saving on the grocer's bill. It means almost the elimination of the doctor's bill. It means an increase through the conservation of tone and energy, in the economic value of the individual for the very best output. There would be less loss of time because of incapacity, greater vigor while working. Therefore, there would be greater income to pay lessened bills, thereby leaving a larger residue for other gratifications."

Doctor Robins gives me this final phrase: "I sincerely hope and trust that none of my friends has ever retrograded, or will retrograde, so far as to eat merely for the sake of eating."

THE PUBLIC HEALTH LABORATORY

BY HERBERT FOX, M.D.

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THE public health laboratory as a unit of the sanitary system of a community is capable of consideration from three different standpoints: First, as a unit of the executive system; second, as the centre from which aid may be given in the diagnosis of conditions concerning the public health; third, as a place of original research.

It is with the second unit that this article concerns itself. The greatest good will come from the public health laboratory when all three phases are fully developed.

The value of the laboratory as a division of the public health office is greatly enhanced by a correlation of its results and those of the division having a closer relation to clinical medicine, that of medical inspection. Original research is suggested likewise by these correlated results.

The public health laboratory bears somewhat the same relation to sanitary science as it does to clinical medicine. In the former case it may originate plans for sanitary problems which will later demand corroboration and control.

To the practice of clinical medicine, on the other hand, the public health laboratory, like the hospital laboratory, deals somewhat less with theory, but supplies supplemental evidence to be added to the clinical examination. Clinical data stand in the place of field work. Diagnoses are not made in a laboratory. The value of laboratory examinations varies directly with the correctness of their interpretation. To no other branch of medicine does this trite remark so sharply apply, and the laboratory man is constrained to rely upon it for his defence, since he is so often held guilty for errors in diagnosis. The clinician, on the other hand, defends himself by stating that he is not a technician. It is undoubtedly true

that the clinician cannot be familiar with the technique of all laboratory procedures, but it behooves him to understand upon what the tests are based and upon what the varying results may depend. An experimenter cannot correctly carry out and prove his theory if he know nothing of the structure and limitations of his instruments.

Unfortunately for medicine, there is practically no laboratory test that is positive under all conditions. The limitations of a test are made up of its fallibility plus the exactness with which clinical difficulties can be minimized. Fortunately for both groups of workers, the necessity of pathological data and their association with clinical material is educating both the bedside doctor and the laboratory worker.

This may not be a bad opportunity to correct the all-too-prevalent opinion that the pathologist sets himself above the clinician. Nothing can be farther from the truth.

It is probably true that many physicians understand the above generalizations about the laboratory without applying them to the public health service. This misunderstanding is due to a failure to appreciate the exacting demands of sanitary science. The red tape so widely condemned is an absolute necessity to the high efficiency demanded by preventive medicine. The uniformity of results, accuracy of detail, and promptness of reporting benefit the individual physician, the executive officials, and the community at large. The federal authorities prescribe a certain manner of the transmission of infective material. For ease of service supplies of these legal outfits are best kept in localities convenient for certain sections of the country. This system may not be suitable for some States, such as those having very long distances between towns, in which case the postal system must be depended upon for distribution and collection. The ideal system would be to have many branch laboratories scattered throughout the country where material may be brought direct. This, of course, is a very expensive method. It might also be added, in passing, that under these conditions the individual clinicians, with their material at hand, might be over-insistent upon the necessity of immediate examination.

Many doctors unfamiliar with laboratory technique expect results about as quickly as they themselves can collect the specimen. The examinations themselves are made by standard methods and, as far

as the laboratories of which I have direct knowledge are concerned, are reported upon in unequivocal terms. The manner of receiving and reporting upon a specimen necessarily varies in different States largely because of the differing views of boards of health upon infectiveness and quarantine. I shall speak of some special methods of report later.

A pathological examination in public health work must be made with a definite end in view. The inspector in the field or the clinician should endeavor to make every test count its maximum, and should avoid asking for unnecessary examinations. A noted medical wit once said, "It is unnecessary to examine a stream for colon bacilli when one sees a privy overhanging it." I do not wish to detail all the possible errors that might be met in public health work, but I can say they arise chiefly because of failure to appreciate precisely what a test is and what it will show. I once had sent to me a mass of blood dried between two pieces of window glass, carefully paraffined together. This was to be examined for cancer of the spleen. It is no uncommon thing for a public health laboratory to receive a smear of blood upon a piece of paper or glass slide upon which a complete blood count is desired. Too often is infective tuberculous sputum sent in cardboard boxes or, once to my knowledge, dried in a mailing envelope! Under such conditions the failure to realize what specimens and examinations really are reaches the height of seriousness.

In a few words I shall discuss some unusual interpretations to be placed upon reports without considering the ordinary findings. The Widal test and diphtheria throat culture may be positive in persons not suffering from typhoid fever or diphtheria at the time. In regard to the former, a condition of the gall-bladder or inflammatory bone disease must not be forgotten. The "carrier" of diphtheria bacilli is a very serious factor in epidemics. There are organisms almost identical with the diphtheria bacillus, only separable by careful animal experimentation. These are responsible for some positive reports in the absence of active angina. The physician should request a determination of virulence if positive cultures remain after five weeks from recovery. The use of the culture test in diphtheria in State medicine is practicable only for the release from quarantine. The statistics of antitoxin injections show us that the mortality rises with the postponing of treatment. It is therefore unsafe to await

the bacteriological diagnosis of diphtheria before using antitoxin. A corroboration may be obtained by sending a culture to the laboratory, but under no conditions should antitoxin treatment be postponed when the throat condition is suspicious. For release from quarantine most authorities require two negative cultures on successive days. There is a tendency to increase this to three cultures on the same number of successive days. In malaria negative results are frequently due to the use of quinine in the forty-eight hours preceding the taking of the blood.

The heads of dogs are frequently sent to the laboratory for the diagnosis of rabies immediately after having bitten some one. The story may accompany it that the dog had no symptoms of rabies. It is usually unwise to kill an animal unless there be symptoms, as Negri bodies may be absent in true cases so early in the disease. Symptoms will certainly appear within ten days, and if the beast can be properly isolated no great injury will be done to the patient. If no symptoms appear in ten days the animal has not been infected. Poisoning by barium may simulate rabies at times, and should be excluded, particularly in animals about places where this poison has been used to kill rodents.

In reference to examination of fæces and urine, both chemically and bacteriologically, great care must be taken in the collection and shipment. Directions of the health authorities usually specify what to do with such specimens. They are offensive, if not actually dangerous. In my experience the physician seldom knows precisely what he wants done, and the laboratory worker is put to great inconvenience to render good service.

The present movement towards the limitation of tuberculosis has disseminated so much information that the physicians are well aware of the value of sputum examination for the tubercle bacillus. They do not realize, however, the significance of other bacterial forms in the sputum. Hemorrhage is often preceded or accompanied by a large number of *Streptococci.* The number of small lymph-cells in the sputum may be of assistance in tuberculosis. The presence of forms resembling influenza is of great importance because it usually presages the extension, or active congestion, of existing lesions.

With reference to morbid fluids and growths there is great misunderstanding. Text-books and pamphlets of instruction should be

consulted or correspondence with the laboratory instituted if the printed instructions are not sufficient.

The sanitary value of the examination of water, milk, butter, and the like should be left to competent sanitarians. Both bacteriological and chemical analyses of these substances are hedged about by technical and physical conditions so that a proper interpretation by the uninitiated is usually impossible. Be it enough here to say that a water containing colon bacilli should not be used for human consumption.

Among the criticisms of the public health laboratory one hears most frequently that this governmental agency is constantly encroaching upon the province of the private pathologist. That this may be true in a minor measure cannot be denied. The changing conditions of this country, moving as it is from empiricism to scientific control, demand a broadening of hygienic regulations and the scientific collection of statistics. Statistics of medical inspection are strengthened when controlled by pathological examination. The weight of a determination coming from a government laboratory increases the precision of the physicians and the feeling of protection of the citizens. The education of the physician in the underlying subject of pathology is also gained. The facilities of a public health laboratory must be open to all citizens. It is, to be sure, of most help to the poor. Those who can afford to pay their physician could, almost without exception, find a small fee for the pathologist. They could find the fee if they had the fashionable disease appendicitis.

To men who have had experience in public health work these statements will not be unfamiliar. To the clinicians who use laboratory facilities I hope I have brought the other side of the question. The public health laboratory really means to assist and not to interfere. Laboratory workers appreciate to some extent the difficulties of the clinician, and I hope some of the difficulties of the pathologist are made apparent or suggested to the doctor.

PELLAGRA

BY GEO. C. MIZELL, M.D.

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ETIOLOGY

No effort will be made to go fully into this important question. I will set forth, as briefly as possible, in correct terms a theory which seems to have a well-founded basis. Space will not permit of data to support this theory, but no statements will be made unless there are sufficient statistics in hand to warrant them. Before going into the etiology it will be necessary to upset the accepted ideas of the seasonal incidence. There are several conditions set forth by Dr. Sambon in developing his simulium reptans theory, which if true in Italy do not obtain in America. The most important of these conditions is that pellagra has a spring and fall incidence. All of the literature that has come under my observation has acceded to the spring and fall incidence by silence. Below is given the month of incidence—*i.e.,* the month in which dermatitis developed, of one hundred cases:

January	1	July	25
February	2	August	11
March	2	September	6
April	14	October	1
May	17	November	0
June	19	December	2

During the past winter, which has been exceptional for cold weather and dark, cloudy days, no less than four cases have developed well-defined pellagra symptoms. It is not to be denied that by far the largest number of cases have a summer incidence, and the development of typical pellagra in a season such as the past winter is not without significance. The winter cases show that this disease is in some instances influenced by season, sunlight in this type

not being the exciting cause of the dermatitis. In the summer cases the disease is often uninfluenced by season, and in this type sunlight is a factor in producing the dermatitis. Thus it must be concluded that there are two types of the disease, *viz.*, one, biochemical pellagra, with a seasonal incidence, and the other toxico-chemical pellagra, with non-seasonal incidence.

Lombroso's theory, which seems to have been proven as conclusively as any proposition in medicine, may be stated as follows: Spoiled corn contains a toxico-chemical agent, which if consumed in sufficient amount for a sufficient time will produce pellagra. This theory classifies the disease as a toxico-chemical disease, and as such it should resemble other toxico-chemical diseases, such as beriberi, ergotism, and alcoholism, which have no seasonal incidence, occurring at any period of the year.

In diseases of this nature the symptoms abate or persist, according to the presence or absence of the poison in the food of the patient. It is said that spoiled corn causes blind staggers in horses, which disappears when the noxious food is withdrawn. Once established, the symptoms of pellagra continue and recur, irrespective of spoiled corn in the diet. It is held, and all of the experiments performed show, that the continuous consumption of spoiled corn causes pellagra; the Italian pellagrins, for example, are said to live exclusively on spoiled corn. Antonini is said to have produced pellagra in seven people by feeding them exclusively on spoiled corn, and Lombroso claims to have produced pellagra in both man and animals. But notwithstanding the mass of authentic evidence, many able investigators have been led, on well-sustained grounds, to reject all theories based upon it. It is inconceivable that a poison formed outside of and introduced into the body as such, can so limit its effects as to become active only under the influence of the sun in some cases, yet in others exhibit the same effects uninfluenced by the sun. Going a step further, may it not be concluded that non-seasonal pellagra alone conforms to the behavior of all other toxico-chemical diseases in that they do not exhibit a seasonal incidence? As it is impossible that a chemical poison formed outside of the body can exhibit the peculiar seasonal activity exhibited in the large majority of cases, we must seek for a contributing cause which is capable of producing this peculiarity. By studying the experimental evidence and iden-

tifying the essential constituent of corn which enters into the formation of the toxico-chemical agent, we may be able to reach a conclusion as to the cause of the other type of the disease.

Aside from the seasonal incidence as opposed to an exclusive toxico-chemical nature of the disease, there is one fact that has not been harmonized with any of the corn theories; most writers on this subject have authentic reports of cases in which corn products could be excluded. I have under observation at this time five cases that have not consumed corn products.

In the experimental work done to show the cause of pellagra, extracts of spoiled corn have been used; the method of obtaining the toxic substances being as follows: The corn is placed in a vessel one-third filled with water and carried through the acetic, alcoholic, lactic, and putrid stages of fermentation. It is then dried, ground, and extracted with 40 per cent. alcohol. The tincture thus obtained is evaporated on a water-bath; the residue contains the toxic substances. In this process no certain organism is mentioned and no particular organism seems necessary. These toxic substances have been designated as (1) red oil of spoiled corn; (2) toxic substance of spoiled corn, or pellagrosine; (3) resinous substance of spoiled corn. The first and third of these substances are clearly of an oleaginous nature; while no intimation of the nature of the second is given, two of the tests to which it was submitted seem to exclude the possibility of its being alkaloid: it is soluble in a solution of caustic potash, and it is precipitated from this solution by sulphuric acid. Another significant reaction is that it produces a green color with copper sulphate. It is claimed that a poisonous alkaloid has been separated from the oil and the resinous substances, but after the separation of the alkaloid, the latter (the oil and the resinous substances) are still toxic in small doses—"a thing which proves that the alkaloid is not the only poisonous substance in spoiled corn." The source of these substances, Peschal states, is through the action of Bacterium madis on the albuminous and oleaginous constituents of corn. That the character of the fat acted upon is important is shown by the fact that no poisonous substance is developed by the growth of Bacterium madis upon other media.

In the process outlined above, the oil of corn would, under the influence of air, moisture, and other ferments present in the corn,

undergo fermentation or oxidation, giving rise to numerous oxidation products, and, from the properties given of the extracts, red oil, pellagrosine, and resinous substance may all be derived from the oil of corn through oxidation. Association with albuminous matter may or may not be necessary. These substances are shown to differ physically, but this may be due to different degrees of transformation and not to any marked chemical dissimilarity, hence they may arise from the same essential substance, which seems to be a certain kind of oil. Following up this suggestion, it will be seen that this oil is present in corn to a greater extent than in any other edible grain or seed, and that the one suspicious constituent of the oil is linolein.

After identifying linolein as the peculiar constituent of corn necessary for the formation of pellagra-producing agents, it is easy to conclude that its presence in like proportion in other oils will render them capable of forming such agents under the same conditions, such as the oil of sesame seed, poppy seed, cotton seed, sunflower seed, etc., also some nuts which furnish foodstuffs. Such a conception removes the contradiction offered by those cases which have not eaten corn, but it includes only one type of the disease and by itself is far from satisfactory.

In an effort to supply the missing link between corn and pellagra, it has been suggested that no one can truthfully deny the place to corn products, and the consumption of cornstarch, corn candy, corn whiskey, corn syrup, and corn breakfast foods has been adduced to support the statement. But the process outlined above for obtaining the toxic agents proves this suggestion to be without warrant. This process excludes the possibility of the poisonous agents passing over into the whiskey, even though they be present in the mash. If a syrup is made from rotten corn, it yet remains to be shown that the poisonous substances are soluble in a mixture of glucose and water.

A reference to the chemical technology of fats and oils shows that linolein is widely distributed in Nature, and, when present in the food, it may occur, to some extent, in animal fats and fatty compounds. In contrast to the ordinary animal fats—olein, palmitin, and stearin, which are among the most stable constituents in the animal body—linolein and the compounds of linoleic acid are very unstable and readily undergo fermentation or oxidation. It is well

known that all seeds containing much linolein easily undergo decomposition.

Suppose, then, that the stable oleyl, palmityl, and stearyl of the animal body are replaced by unstable linolein compounds, does it not follow that such animal tissue becomes unstable and that there may be developed in the body a biochemical poison related to the "toxico-chemical" agent of spoiled corn?

While recognizing the possibility of producing pellagra with spoiled corn, not one case has come under observation in which satisfactory investigation did not show the consumption of cotton-seed oil, and for this reason I am disposed to believe that the consumption of this class of oils, *beyond a certain limit,* is the essential primary factor, and that the seasonal influence is the exciting cause of the exacerbations in those cases exhibiting a seasonal incidence, while spoiled corn or oil expressed from fermented seed is the exciting cause in those cases uninfluenced by the sun.

The few objections so far expressed in opposition to this conception of the disease have not been founded on facts.

Statistical data are in hand to show that pellagra is confined to those regions in which linolein is consumed. In investigating individual cases, the time covered should be the last twelve months, and no evidence should be admitted that does not identify the brand of cooking fat or butter-substitute used.

The time is approaching when the history of cases as to recurrence will be of conclusive value; up to the present there has been no return after the suspected cause has been discontinued. Three cases under observation continued the oil and had a recurrence after leaving off corn products. These observations include the summer of 1911, up to April 25, 1912.

The case histories given below will present the usual symptoms of the clinical cases, and, since the usual features have been well covered in American literature, there is no need to take up space here.

In observing patients with the idea of gaining some knowledge of the effects of cotton-seed oil consumption on general health, I have arrived at some conclusions which have materially aided in diagnosis, prognosis, and treatment.

No case has been included in my records as pellagra unless the dermatitis has developed. Not infrequently cases come under obser-

vation with many or all of the symptoms of pellagra except the dermatitis; others present symptoms which are in no way indicative of the classical pellagra, but, because of a history of oil consumption, have been placed upon pellagra treatment with the most gratifying results. I have observed patients for four or five years coming regularly every year for treatment for an exacerbation of symptoms, finally develop the characteristic lesions. Various attempts have been made to identify localized lesions in the cerebrospinal system, gastro-intestinal tract, gall-bladder, or epithelial tissues, as being the essential pathological developments, but none of these suggestions have been supported. There is a marked difference in the cases that came under my observation before 1910 and those coming since that date. Almost without exception, the early ones were serious and rapidly fatal, and, judging from these cases, one would conclude that the disease was of gastro-intestinal origin. Hypo-acidity was the rule; indeed, it was seldom that a trace of acid could be found.

Of the cases coming in 1910 and 1911, over sixty per cent. show a fair degree of acidity and not a few a normal or hypo-acidity. This important difference may be explained by assuming that dyspeptics, always on the lookout for easily-digested food, were the first victims through selection of diet and increased susceptibility.

DIAGNOSIS

In the application of this theory, it must be borne in mind that the relative proportion of the various kinds of fats consumed is very important to the individual. No one would contend that a well-balanced mixed diet, containing sound corn, would be injurious on account of the presence of linolein in the corn. Walnuts, fish, animal tissue, and other foods containing linolein may also be consumed with impunity, and from information obtained from patients we note a marked difference in effects, according to whether they eat compound lard, or summer or winter oil.

Where the amount of fat consumed is small, or where it is used in the fall of the year only, as is the case with many farmers of the South, symptoms may endure a number of years before becoming serious; indeed, they may be so slight as not to call for attention. The most common early symptom is a fairly characteristic tongue.

The tongue of the early pellagrin is usually sensitive and red around the edges and tip. Often there is a spot on the dorsum which is red, sensitive, and lacking in some layers of epithelium. Sometimes there is a burning in the stomach, œsophagus, and tongue; sometimes it affects the tongue alone. These symptoms often occur throughout the summer and winter, but are seldom continuous.

The pellagrin often gives a history of early constipation, and this is to be expected, for the suspected oils do not possess the laxative properties of fats composed of olein, palmitin, and stearin.

Next in order of early symptoms, especially of brain workers, are nervousness and insomnia which are not relieved by rest. Another common symptom is burning of the hands and sometimes of the face and feet. This occurs only after the bright weather of summer has begun, but seldom in the winter, even in acute attacks of pellagra.

There is no other condition in which this peculiar burning of the hands and feet is present. My cases presenting the above symptoms are always linolein consumers, and are, consequently, treated as pellagrins.

The average case of pellagra is easy to identify. However, I have frequently been called to see cases in which the diagnosis was based upon a history of linolein consumption alone, and the importance of taking this into consideration is demonstrated continually. As an instance, a brief history is given of a case seen in September, 1911.

Previous history: Miss B., age 26. Confined to bed four months. Menses suppressed 6 months. Decline had been gradual since spring, 1911. No diarrhœa until two days ago. No appetite; refuses nearly all food and medicine. Periodic attacks of nausea and vomiting. Present condition: Emaciated; diarrhœa; nausea; vomiting. Mouth sore and red. Insomnia. These symptoms had been present only a few days. Presented the appearance of infective, exhaustive psychosis. Father, who was a grocer, denied the use of cotton-seed oil, but, upon request, presented six buckets, only one of which was labelled lard. Inspection revealed slight erythema on hands, which had not been noticed by nurse, who stated that patient had been confined to room three months. Investigation brought to light a hammock swinging between trees in the yard. The patient had been spending the days in the hammock for a week. Since exposure, symptoms had become more marked. Before this exposure, diagnosis of pellagra could not have been made without recognizing the etiological factor. As a result of exposure, typhoid pellagra developed and was fatal in one week, patient having refused all treatment.

By making a series of examinations of the stomach of pellagrins and other cotton-seed oil consumers who were suffering with gastric disturbances, it was found that all of the pellagrins and many of the other oil consumers gave the ulcer blood spot with Einhorn's thread test. This test was positive with hydrochloric acid present, as well as in anacidity. Ulcer and cancer, in many cases, could be excluded only by observing the progress of the case.

PROGNOSIS

In the senile the outlook is usually grave. This is especially true when diarrhœa and mental symptoms are present. Surviving the attack of pellagra, their constitutional resistance is so lowered that they fall an easy prey to infectious diseases. There is only one fact which justifies even a guarded hope for ultimate return to good health. If examination of a test-meal gives hydrochloric acid, the prognosis is always good and offers the only hope for the aged. Without hydrochloric acid in the gastric secretion, all cases should be regarded as grave, so long as diarrhœa exists. Persistent clay-colored stools may indicate gravity. When the residue, after Ewald's test breakfast, is composed of over three ounces of yellow alkaline material, the directions should be exacting. Of course, much depends upon the stage in which the patient is presented for treatment. Mild attacks, in the otherwise healthy, will pass without treatment. Many would probably recover and stay well without treatment, but it is doubtless true that every attack of pellagra does, more or less, permanent damage. A limited experience with winter cases tends to the belief that they are less serious than those occurring in the summer, and because of climatic influences the outlook is better for those occurring late in the hot season. When there has been recent exposure to sunlight, no prognosis should be given until a week has elapsed. Typhoid pellagra may be precipitated by exposure alone, and the prognosis here is always grave.

In seasonal pellagra, the skin lesions indicate nothing beyond recent exposure. When they involve the covered surfaces, it indicates a hard fight. Recently-developed nervous and psychic symptoms do not alone furnish grounds for a grave prognosis, but when they have persisted, permanent damage may be expected. Patients who have attacks in the spring and summer should, if circumstances

permit, be sent to a cool, dark climate as soon as the serious symptoms have been overcome. Recovery thus may be hastened and the injurious effects of hot weather be avoided.

In our present knowledge of metabolism there is nothing upon which to base our opinion as to how long a certain chemical compound remains a part of a tissue before being used up in destructive metamorphosis, hence we are in ignorance of the duration of residence of the fatty constituents in the body.

Suggestive information is obtained by observing the recurrence of the dermatitis. When this symptom appears in the spring and is violent, there is usually rapid desquamation with complete abatement in four to eight weeks. It will then be seen that the epidermis is thin and that the subcutaneous cellular tissue has to a great measure—if not entirely—disappeared. Should this process involve only a limited area, the skin not previously affected may become involved at any time upon exposure to sunlight or the introduction of the toxico-chemical exciting agent.

During this second attack the first area remains unaffected for some months, or until there has been a reconstruction of the epithelial structure and subcutaneous tissue, after which the dermatitis may recur at this site. (See Figs. 1 and 2 and Case 6.)

These recurrences do not take place without the effect of the exciting cause, hence the patient should be protected from the sun until winter and avoid the other exciting causes for twelve months, and no case should be pronounced cured until after such time. Even then there often remains a sensitiveness to light, but not because of a pellagrous condition or pellagra would develop, any more than a victim of isolation, who is sensitive to light, suffers sunstroke every time he is exposed.

TREATMENT

If the above conception of the disease is correct, it becomes apparent that there is no specific for it in the sense that quinine is a specific for malaria, or antitoxin for diphtheria. All that any treatment can hope to accomplish here is to protect the tissues and reduce the sequellæ to the minimum. Unlike all other diseases, pellagra is a condition in which the more slowly the primary cause is eradicated the less damage is done. Time is required for the removal of the

unstable constituents of the tissues which seem to serve normal functions fairly well under some conditions. These conditions appear to be in the nature of influences favoring slow oxidation. This is in evidence in the beneficial effects of mental and physical rest and in protection from sunshine, and in the evil effects of incidents which call upon the reserve fuel of the body.

By respecting these views, the "peculiar exacerbations" by which pellagra is characterized may be avoided. The treatment to be outlined is especially directed to the relief of these exacerbations, but, these being relieved, much still remains to be done before these patients are out of danger. The course of the disease in the exacerbations and following them can be greatly influenced, but, as in other diseases, much irreparable damage may occur even before the diagnosis is made.

As stated above, until 1910 all cases of pellagra that came within my observation were of a serious nature; with rare exceptions, they were rapidly fatal, and this termination was then considered inevitable.

In June of 1910 there came under my care a patient who for several years previous had been treated for an acid gastritis. Hyperacidity had been demonstrated by test-meals in 1909, and also several years before. When she came under observation in the spring of 1910, she was suffering from psychic symptoms and had a well-developed dermatitis and stomatitis. No test-meal was taken at this time, but in July, 1910, hypo-acidity was demonstrated.

This patient had been continually on symptomatic treatment for several years, and, notwithstanding excellent management, in the first half of 1910 pellagrous symptoms were becoming more marked and she was rapidly losing weight. The treatment which was promptly effectual in this case was as follows: No sunlight was allowed to enter the sick-room. At first confined to bed, in a few days patient took walks in the hall of the infirmary, if so inclined. Daily sponge-bath. Liberal diet of milk, bread, meats, vegetables, and light desserts.

℞.—Calci sulphidi, ½ grain before meals.

℞.—Tincturæ nucis vomicæ........................gtt. x
Acidi hydrochlorici diluti........................gtt. x
Essentiæ pepsini ....q.s. f℥ii

M. Sig. Give in three ounces of water, through tube, after meals.

Patient made uneventful recovery and did not have a recurrence in 1911.

As all treatment heretofore used had been without avail, calcium sulphide was given credit for the results, and from this experience my present treatment has been evolved.

In mild, uncomplicated cases scarcely any treatment is needed, but, as it cannot be foretold when a mild case will develop serious symptoms, they should all be guided by certain general rules. The hygienic management should, of course, embrace the general requirements conducive to good health, such as plain, simple, nutritious food, regular hours, and sufficient rest. Where circumstances permit, outdoor exercises should be taken before eight o'clock in the morning and after five in the afternoon on days when the sun is shining. Exercise is always to be moderate, never enough to fatigue. Calcium sulphide in ½-grain doses before meals should be given.

It is not often that mild, uncomplicated cases of pellagra present themselves for treatment, hence a thorough examination of the vital organs, secretions and excretions should always be made. The generative organs in the female should be carefully examined. No simple deviation from the normal should go without attention, for, bear in mind, these patients are very susceptible to direct and reflex influences. For the sake of the digestive tract, do not overlook the teeth. One exception to this general overhauling is that until the pellagrous symptoms have passed off no attention should be given to defects in vision, as these are often transitory.

DIETETIC TREATMENT

For obvious reasons, all cereals containing much vegetable oil, such as corn products and oatmeal, should be interdicted. Mild, uncomplicated cases, without pellagrous diarrhœa, may be given any plain, nutritious diet, avoiding fried foods, acids, and concentrated sweets. They may also have grapes, oranges, and peaches in limited amounts. They should have as much food and as varied a diet as the condition of the stomach and bowels will permit. Meats are usually better borne than any class of foods as a whole, and should be given twice a day, preferably roast and broiled beef, mutton, and chicken. When stomatitis renders chewing painful, the meat should be well selected, tender and free from connective tissue, and scraped or ground fine; thus prepared, broiled, and fed with a few crackers or toast, it has a marked beneficial effect on the sore mouth, without irritating it. Except in unusual cases, where diarrhœa seems to be unfavorably influenced by meats, they should be depended on in all serious phases of pellagra.

The physician in pellagrous regions will often be confronted with cases presenting the following symptoms: persistent nausea, vomiting, salivation and stomatitis, and diarrhœa or constipation; very feeble heart action may also be present.

This combination of symptoms is always serious, and prompt, cautious action is necessary. Diet here is of the first importance, and after experience with a large number of cases, the following directions are insisted upon: When the circulation is good, a glass of sweet milk, to which an ounce of lime water has been added, and two or three crackers are given every two and one-half hours. In some cases when the milk is not retained, or the circulation is weak, solid food, *viz.*, broiled, scraped steak or chicken, with crackers or toast, should be given every two and one-half hours. During such attacks the water is limited to one glassful, one-half given with the solid food, one-fourth with the medicine before eating, and one-fourth with the medicine after eating. Special emphasis should be laid on chewing the solid food well, and all inclination to wash the food down with water should be resisted. In controlling the nausea and vomiting, no agent is as effective as the solid food above indicated, and when milk is not retained it is always resorted to. Often it is not an easy task to induce the patient to take nourishment, but by promising relief from these distressing symptoms the physician will rarely fail in his efforts.

After nausea and vomiting have been controlled, special attention should be given to the diarrhœa if it persists. By far the most successful diet in managing these symptoms consists of meat, medium done, with a small amount of toasted white bread or crackers. The food should be given at three-hour intervals. It is rare for the diarrhœa to improve when only milk in which a raw egg has been beaten is given; on the other hand, this symptom yields to treatment only on a mixed diet of meat, eggs, milk, and breads. Fats are to be prohibited except when constipation exists. When there is no tendency to diarrhœa, the diet needs to be limited only by the gastro-intestinal problems of each individual case. In extending the diet, great care should be taken to prevent a recurrence of the diarrhœa, and this can best be done by adding one article of food at a time. Upon any indication of a relapse, it should at once be restricted by safe limitations. It is a great mistake to overfeed these patients and

try too rapidly to increase their weight, or to stimulate a lagging appetite by active exercise.

The weakness in these patients is often not due to a lack of nourishment, but rather to quality of tissue which can be improved—not rapidly, but gradually. Only in the mild cases and those who have had no pellagrous diarrhœa are buttermilk or fermented milk and fruits to be permitted. Alcoholic and predigested foods containing alcohol are never allowed in any case. This rule should never be deviated from.

DRUGS IN PELLAGRA

Promiscuous drugging of all sorts is, as a rule, in the highest degree detrimental. Unless the proper management is at the same time instituted, experience will soon teach one to distrust drugs in the treatment of pellagra. Perhaps improvement is due to the management rather than to the various remedies which have recently received credit for giving relief. Among the remedies for which claims are now being made are the derivatives of arsenic, and it is not to be denied that the credit given arsenic is justified. A great many cases have no doubt been benefited by this remedy, together with proper hygienic, dietetic, and prophylactic management. This much is conceded, but at the same time there is no doubt in my mind as to calcium sulphide being the best remedy, and some investigations which I have made here led me to believe that others are getting equally good results by this same method. Not only are good results apparent in the progress of the patient by relief of pellagrous symptoms, but these patients feel best when on the remedies outlined below.

Some to whose attention this treatment has been outlined have been skeptical. During last summer, 1911, a personal friend, a physician, requested that he be shown some of the results claimed for the treatment. He was carried to see two apparently hopeless cases. After his first visits he remarked: "One thing I have noticed, and that is that the patients are satisfied—a state of mind that I have not seen before." He followed these cases for a month, and was convinced that the progress made was up to representations.

All cases are placed upon 1/6-grain pills of calcium sulphide.

This is usually given in three pills before each meal. The number of pills may be increased to as many as twelve (in a capsule) at a dose, but rarely are more than six needed. When there is hypo- or normal acidity, or where there is belching of sulphuretted hydrogen, an enteric pill should be given. The physician should always be sure that the patient gets calcium sulphide, *i.e.*, that the pill is soluble and that it has not *decomposed*, as it is so prone to do. Never prescribe a pill containing more than one-sixth of a grain or in tablet form, as they are worthless. In nearly all cases one of the three prescriptions given below is indicated.

When the mucous membranes are involved and there is acid in the gastric secretion up to or above normal, give:

℞.—Sodii chloratis .... ʒii
Aquæ .... f℥vi

M. et ft. sol. Sig. Two teaspoonfuls in one-quarter glass of water, one-half hour after meals.

In hypo-acidity give:

℞.—Sodii chloratis .... ʒii
Acidi hydrochlorici diluti......................... f℥ss
Essentiæ pepsinæ .... q.s. f℥vi

M. et ft. sol. Sig. Two teaspoonfuls in one-quarter glass of water, one-half hour after meals.

This prescription should be taken through a tube, or in mouth rinsed with water in which a pinch of baking soda has been dissolved.

To stimulate appetite, tincture of nux vomica in doses of ten minims may be given, with either of the above properties. These prescriptions are given in all cases with gastro-intestinal symptoms. However, there are times when they may be suspended for a day or two in order that more attention may be given to the administration of food and other remedies for nausea and vomiting, which are sometimes the most obstinate of the serious symptoms, and for which all efforts for relief should be instituted. Should these symptoms continue for twenty-four hours after beginning the above prescriptions and diet, leave off the medicines and administer:

℞.—Pulveris acaciæ ....ʒii
Bismuthi subcarbonatis ....ʒii
Calcii carbonatis ....ʒi
M. et ft. pulv. No. xii. Sig. One powder in little water before eating.

Should constipation exist, ten grains of calcined magnesia (light) may be added to the above. These measures, persisted in, will relieve the nausea and vomiting, and after forty-eight hours the former treatment should be resumed and continued throughout the duration of the pellagrous symptoms.

Some palliative treatment is often needed for the numerous complications which arise, and, although these complications may present classical features of an independent disease, it is often the case that they do not yield to recognized treatment for these conditions.

Surgical measures should rarely be instituted during an attack of pellagra, and more especially in a case where an attack is impending. Not infrequently has a serious attack been precipitated by operations for gall-stones, ovariotomies, and hysterectomies, when the condition for which the operation was performed was in reality a part of a pellagrous process. However, should the pellagrin have been relieved for some months, the past attack is no bar to surgical measures. In fact, at this period, these patients appear to recover rapidly from operations.

As no treatment will give the best results without the proper consideration of the adjunct measures, those that have been of value will be given in detail.

Skin.—The cutaneous lesions of pellagra are self-limited, and very little treatment is needed, and it is inadvisable during the erythematous and inflammatory stages. Protection from sunlight is essential to the comfort of the patient.

When the corium is exposed by desquamation and a serous exudate or abrasions predispose to infection, or when crusts need to be softened, apply any bland ointment, as ointment of zinc oxide with ichthyol (5 per cent.). Keep the parts exposed to the drying influence of the air. Burning and tenderness of the skin of the extremities sometimes yield to a warm or cold bath, and a rub with powdered salt or lard. These symptoms may subside, however, only when calcium sulphide is pushed to the limit.

Exposure to strong incandescent light rays often suffices.

Mouth.—In salivations, as in many other symptoms, too much treatment is usually given. The mouth should be sponged or washed after each feeding with a solution of chlorate of sodium, 1 to 100.

Pellagrous stomatitis is not an ulceration, but is allied to the dermatitis, in that the superficial epithelium is involved. Atropine, 1/150 to 1/200 grain, has been given for the salivation, but its use has been almost abandoned as unnecessary and inadvisable. It should never be given when mental symptoms are present.

Stomatitis, accompanied by dryness of the mucous membranes, can be alleviated by spraying with liquid alboline and moistening frequently with cinnamon water. Pilocarpine, 1/20 grain, should also be given at bedtime, or twice daily.

Ulcers are rarely seen, and when present should be mopped with nitrate of silver solution, 40 grains to the ounce. A strict dietetic régime is all-important in keeping these distressing symptoms in abeyance.

Stomach.—In addition to the measures indicated above, it may be necessary to give relief from pain. Paregoric with bicarbonate of sodium will often tide the patient over in such an attack. Constant application of hot-water bottles may be needed. When the mucous membranes permit, gastric lavage every other day with warm water to which subnitrate of bismuth and bicarbonate of sodium have been added will improve the condition of the organ.

Pyrosis.—In these cases it is not due to acid in the stomach, but yields without other measures than the regular pellagrous treatment.

Muscular insufficiency, so common in pellagra, does not often give rise to gastrectasia, but dilatation and gastroptosis often call for a suitable binder, to make walking patients more comfortable.

Intestines.—In by far the majority of cases, if not in all, the status of the bowels will control the issue. In many cases the intestines, although crippled themselves, are called upon to do the work of the stomach also. Pains may call for relief by hot applications, paregoric, and colon irrigation with a solution of bicarbonate of sodium on alternate days, with warm water to which a drachm of compound tincture of iodine has been added. Proctitis may be relieved by irrigation with the same solutions.

Deficient secretion of bile may play a part in diarrhœa, and

calomel may have to be given daily, a grain at bedtime. Rarely the diarrhœa persists after the above treatment is instituted, in which case careful examination of the gastric contents and fæces may reveal some independent disease which is causing it. The usual remedies—opium and astringents—for diarrhœa have no place in pellagrous diarrhœa, and, while the frequent movements may be checked, they will return, and in the meantime mental and nervous symptoms may have developed or have been aggravated. This class of remedies may be of benefit in complicating diarrhœa of non-pellagrous origin.

For constipation, the best remedies are castor oil and the sulphate of magnesium and sodium.

Heart.—If due attention is not paid to the circulation, some patients who seem to be progressing well suddenly succumb, without giving so much as a sign of cardiac weakness. The nurse may find a lifeless patient who a few minutes before was bright, cheerful, and apparently vigorous. Cardiac weakness is most liable to develop during diarrhœa and vomiting. Nitroglycerin, digitalis, and strychnine should be given, and with this sparteine sulphate and adrenalin, if needed, to keep up force and tension. Anticipate rather than be too late.

Murmurs, related to anæmic murmurs, are often present even in cases with slight pellagrous symptoms; they do not add to the gravity of the situation.

Genito-urinary symptoms are often present in the female, and are frequently distressing. Ovarian and uterine pain may demand administration of anodynes and local treatment. Vaginitis and vulvitis can be relieved by douches of the solutions recommended for colon irrigation. For irritation of the external surfaces apply vaseline night and morning, after a bath of cold water. Painful and frequent urination is relieved by a few doses of acetate of potassium and the elixir of saw palmetto.

Insomnia is rare in a properly-managed case, the sleeplessness being often the result of some discomfort. As sleep is greatly to be desired, pain should be relieved and hypnotics given. When pain is present, paregoric, a teaspoonful, and four grammes of veronal dissolved in water should be administered, and these doses may be re-

peated in one or two hours, if needed. Veronal in solution is a harmless remedy for producing sleep in these patients.

TYPHOID PELLAGRA

No attacks of this type have developed in patients after they have been placed on the above treatment, hence limited experience does not warrant an opinion as to the best management. Although it is admitted that little can be done to relieve these cases, much may be accomplished to prevent such a fatal state. Much stress has already been placed upon the influence of light and heat, and further observation may show that these influences are the most common exciting causes of typhoid pellagra and other serious developments. It is not unusual for a turn for the worse to date from a move to the hospital or from a few hours' exposure to strong daylight. Thus, in some of these manifestations there may be an analogy to heat-stroke and sunstroke. The susceptibility of pellagrous tissue to light rays soon teaches the intelligent afflicted to seek the shade. However, before the lesson is learned, or acting on the advice of the medical attendant, the stroke may fall. Well-meaning, yet misguided, friends and relatives sometimes overcome the inclination of the victim to seek a dark corner. Fortunately, some are beginning to believe that "God's sunshine," while beneficial, properly applied, is fraught with harm in overdose.

The best method of dealing with "typhoid pellagra," then, is to prevent it. When developed, sustain the patient; keep the temperature within harmless range by sponging, and by absolute quiet, and give the treatment as indicated above.

Psychic Symptoms.—These are not infrequently the most prominent symptoms. In many cases these manifestations are acute and transient, yet it is probable that every attack of pellagra does more or less irreparable damage to the cerebrospinal system, and to a certain degree this may be true of all the tissues. Should mental and psychic symptoms persist after the relief of the other active symptoms, then the case becomes one of insanity and should be managed accordingly. As yet no marked mental or psychic symptoms have remained in patients who have persisted in the treatment outlined above. This is probably due as much to prophylaxis as to

the treatment. By prophylaxis here is meant the protection of the patient from the sun.

For these symptoms no special treatment is given. Usually there is immediate improvement upon the administration of calcium sulphide. Hydrotherapeutic measures, when available and selected according to the individual case, are valuable aids. Wet compresses applied to the limbs are grateful to those suffering with pains in those parts. Extremes of temperature should be avoided during the presence of marked irritation, but good results may be obtained by using these measures after the pellagrous symptoms have subsided. The same may be said of galvanic and faradic electricity. Vibratory and electric massage should be used in cases where there are tenderness along the spine and changes in the cord.

The physician who is conversant with the principles involved in the therapeutic and physiological application of these measures will recognize their field of usefulness in restoring stability to tissues that have been rendered feeble from any cause. Of great importance is the expressed attitude of the medical attendant in the presence of these patients. Being in general very susceptible to morbid impressions, the pellagrin should have continually impressed upon him the nature of the disease and the possibility of relief. He should also be assured that after twelve months, through treatment and prophylaxis, there will be no return of the disease, although he may experience suggestions, through susceptibility to light influences, of a recurrence.

CASE HISTORIES

CASE 1.—Mr. B. Aged 30. Weight, 140 pounds. Carpenter. Cotton-seed oil, 3 years. Father has pellagra. Came for treatment, August 2, 1911. Good health till March, 1911, when he began to suffer with diarrhœa and stomatitis. On April 30, dermatitis appeared on the hands, which are now red and covered with mealy scales. Appetite poor. Has dyspnœa and palpitation. Is very nervous, but sleeps well. Temperature 99.4° F. Three to six watery stools daily since March. Physical examination, negative. Test-meal gave 6 ounces of yellow residue containing food and water. Reaction, alkaline.

Treatment.—Calcium sulphide, 3 pills, 1/6 grain each, before meals.

℞.—Potassii chloratis ....ʒii
Acidi hydrochlorici ....f℥ss
Essentiæ pepsini ....q.s. ad. f℥vi

M. Sig. Two teaspoonfuls in one-half glass of water, one-half hour after meals.

Diet.—Milk with egg and crackers every three hours.

Progress, September 21.—One or two stools daily since beginning treatment. Stronger.

October 6.—Bowels loose for three days. Weight, 141. An examination of a pill showed no calcium sulphide to be present.

October 13.—Bowels regular. Appetite poor. Stronger. Medicine continued, and the tincture of nux vomica.

October 23.—Has returned to work. Bowels, two stools daily. Appetite better. Weight, 144.

March 23, 1912.—Patient has been compelled to work out of doors at carpentering all winter, although he is physically unable to do so. Weighs 151. Bowels are regular. Has had frequent colds and cough during this period, but is better now. He refuses to bring sputum.

April 1, 1912.—Has had slight dermatitis, but is stronger, and is better able to work. Bowels, regular. Sleeps well.

This case is reported as the nearest to a recurrence of any of my cases, but it is not to be considered as a test-case, under treatment. All of the conditions favored recurrence. Oil was consumed until August, 1911, and he is of a blonde type that does not tan. The slight dermatitis without other symptoms in this case is not discouraging.

CASE 2.—Mr. H. Aged 30. Machinist. Good health until March, 1911, when he began having stomatitis, diarrhœa, and dermatitis, which cleared up in two weeks, but which returned in June of the same year. Came for treatment, September 22, 1911, complaining of weakness, with loss of appetite; sore mouth; fulness after meals; burning and soreness in stomach; shortness of breath; five or six watery stools daily; sleeping poorly; dermatitis on hands and arms.

Physical examination negative, except that a test-meal shows 3 ounces of yellow, alkaline residue. In fasting state there are present 2 ounces of yellow alkaline fluid.

Treatment.—Same as in Case 1. Uneventful recovery.

CASE 3.—Mrs. X. Aged 42. Residence, Atlanta, 7 years. Weight, 160 pounds. Height, 5 feet 8 inches. No prodromal symptoms. On December 16, 1911, began feeling sick and complained of general weakness, loss of appetite, and dizziness. There was present upon the back of the hands a dermatitis which was confined to the areas that show normal in Fig. 1. There was a free flow of tenacious saliva of a salty taste; some nausea and vomiting.

After a few days' treatment by Dr. J. C. White these symptoms abated and the patient continued in fairly good health until January 11, 1912, at which time the dermatitis reappeared, but in a new area involving the skin of the fingers, thumbs, and wrists. The dermatitis resembled an erysipelatous inflammation. The mucous membrane of the mouth presented the appearance of a general inflammation. The buccal mucous membrane, the buccal surface of the gums, and the under-surface of the tongue were covered with a white membrane. Nausea and vomiting were constant symptoms. The bowels were

in fair condition, only three or four soft stools daily. Temperature 101° F. Pulse 120, and of a fairly good quality. Sleep was much broken by the constant necessity of expectorating. Reflexes exaggerated. Examination showed nothing of importance not recorded above, except vomited material showed mucus and no hydrochloric acid.

Treatment.—Two 1/6-grain pills of calcium sulphide were administered every two hours before eating, and the following mixture was given in a quarter of glass of water fifteen minutes after each meal:

℞.—Sodii chloratis ....gr. iv
Acidi hydrochlorici diluti ....gtt. x
Essentiæ pepsini ....f℥x

Diet.—Crackers, scraped broiled steak, and one-half glass of milk every two hours.

Although it was midwinter, it was thought best to exclude sunlight from the sick-room.

On January 25th the condition of the patient was as follows: The dermatitis had gradually spread until the areas shown in Figs. 1 and 2 were involved. Large blebs which had formed and broken exposed the corium, from which there was a serous exudation. This exudate was decomposing. The crusts were beginning to curl and cut into the exposed corium. A dermatitis developed on the feet, knees, elbows, and hips. There was a vaginitis, with œdema of the vulva and an irritation of the mucous membrane and skin covering the vulva and surrounding parts. No nausea and vomiting were present after the first day. The condition of the mouth was much improved. The flow of saliva was reduced by half, but the patient complained bitterly of the necessity of expectorating, which interfered with sleep. Prostration was marked. There was wrist-drop, especially of the left hand, and inability to move the fingers except with great difficulty. Heart sounds were fetal in character. Pulse 160. Temperature range, 99° to 100° F. Intervals between the feedings were changed to three hours, the prescriptions were continued. Digitalin, nitroglycerin, and strychnine were ordered every six hours, and sparteine sulphate, a grain every four hours. Hypodermic of morphine, 1/8 grain at bedtime for sleep for several nights. Zinc oxide ointment, with ichthyol, 5 per cent., was applied on cotton to the hands. A vaginal douche of warm water containing bicarbonate of sodium was given, and the vulva covered with vaseline.

The patient gradually improved and was out of danger in one week. About February 15th the patient was allowed to sit up. On March 1st convalescence had progressed rapidly. Patient was walking about and had regained use of hands. During this time the diet was gradually added to and the intervals between meals lengthened until it was a general diet with three full meals daily.

The interesting points in this case are: (1) Season of incidence; (2) the acute nature of the attack; (3) the good physical condition of the patient; (4) two attacks of dermatitis in one month; (5) well-marked new area of dermatitis in the second attack. The patient gave a history of cotton-seed oil consumption, which had been dis-

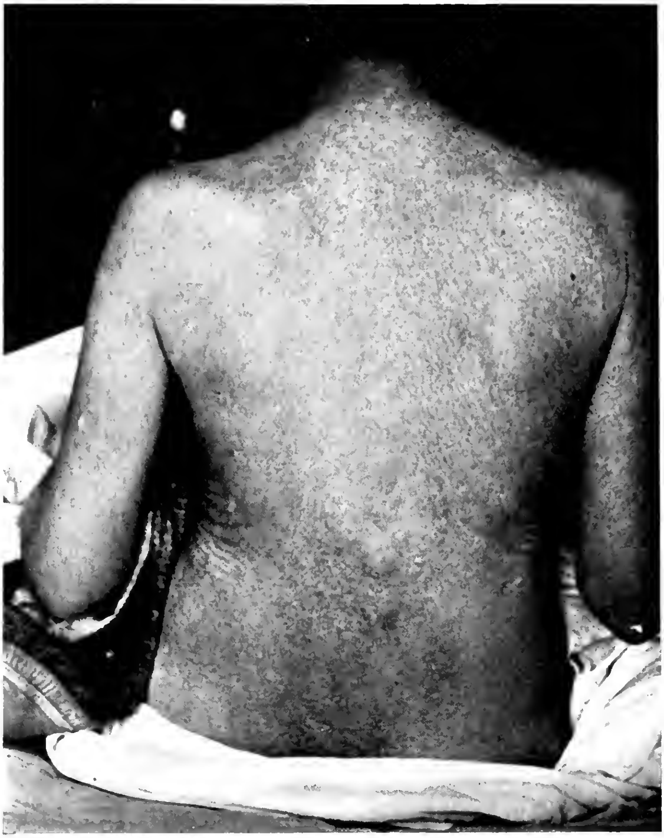
Fig. 1.

Posterior surface of hands and portion of forearms of a pellagrin.
(See Case 3, page 97.)

Fig. 2.

Palmar surface and wrists of the same patient as Fig. 1.

Fig. 3.



Posterior surface of trunk of a pellagrin, showing desquamation.
(See Case 4, page 99.)

Fig. 4.

Left leg of a pellagrin, showing desquamation. (Same patient as the one in Fig. 3.)

Fig. 5.

Hands of one affected with recurrent pellagra. (See, also, Fig. 6.)

Fig. 6.

Swollen legs, varicose veins, and pellagrous eruption of Case 6, described on page 100.

continued two months before the first attack, but she had eaten corn-meal, notably bad, two weeks previously.

Case 4.—Mrs. X. Widow. Aged 52. Residence, Atlanta. Her general health has been poor for 20 years, she has had female and bladder trouble since 1907, and attacks which have been termed acute indigestion for 15 years. Operation for gall-stones on July 28, 1911. Reacted poorly. Developed diarrhœa and sore mouth late in August. No appetite. Very nervous. During the last week in August the patient was placed on the porch, where she was exposed to sunlight. In a few days a dermatitis appeared on the hands. Soreness of mouth, diarrhœa, nervousness, and increased insomnia. Mental symptoms: vertigo and pains in the extremities were distressing. Patient complained so bitterly that she was moved into the house, but she was placed in a room where she could be given a sun-bath daily. The progress of the case was so unsatisfactory that the attending physician withdrew, and I was called in on October 11th. The complaints of the patient were briefly as follows: Extreme vertigo; aching and shooting pains in extremities; frequent and painful urination; slight diarrhœa; no appetite; insomnia; hysterical attacks; extreme nervousness; dyspepsia; eyes sensitive to light; a feeling as if she was going to lose her mind.

Physical Examination.—The patient appears poorly nourished, and the body is pale. Mouth red; teeth have been extracted. Pulse 80. Respiration 30. Temperature 99.4° F. Superficial reflexes are greatly exaggerated. A peculiar phenomenon was a reversed knee-jerk. Ewald's test breakfast shows hydrochloric acid present. Free acid, 14. Total acid, 26. A large amount of mucus is present in lavage. No intestinal parasites were found. Urine was negative, except low specific gravity.

Treatment.—Patient was placed in a dark room and given a liberal diet as indicated above. Calcium sulphide, 6 pills, $\frac{1}{6}$ grain each, before meals. Hydrochloric acid, chlorate of sodium and essence of pepsin, one-half hour after meals. Acetate of potassium, 10 grains every four hours, was also administered.

The progress was at first slow, but evident. Constipation was present in a few days and was relieved with castor oil. All of the symptoms were gradually relieved, except the shooting pains and occasional return of painful urination. At times the pains were so great that opium alone would relieve them. As a result of the sun-baths, there developed a dermatitis covering the body and extremities. Figs. 3 and 4 show the process of desquamation. The limbs were more severely affected than the body. A half-pound of hair was combed from the head during the two months following the exposure to the sun. April 20, 1912, patient is in better health and heavier than in ten years. Deep reflexes are normal. The only complaint is from hemorrhoids.

Case 5.—Mrs. Z. Aged 40. Has eaten compound lard for 18 years, and has been in bad health for 15 years. Was under treatment for stomach trouble from 1904 to 1908, with a diagnosis of achylia gastrica. Diarrhœa and extreme weakness were present in warm weather from 1904 to 1912. Mouth sore every summer for years. Dermatitis appeared in 1908, and has been present every year since from May to September. Management during these months excluded cotton-seed oil products, but these were resumed in the winter and were finally discontinued in March, 1912. Recurrence is looked for. This patient was treated with

arsenic, and the results do not compare with those obtained with calcium sulphide.

Case 6.—Mrs. W. Aged 37. Weight, 126 pounds. Came for treatment in July, 1911. *History:* General health good until one month ago. Has had dermatitis in the spring for four years. Some cough, four years. In February, 1911, hands, arms, and face were severely broken out. Cleared up in a few weeks and returned six weeks ago. Has lost 14 pounds in two months. Present diet, butter, biscuit, milk, and eggs. Appetite good, until one week ago. Sore mouth, three weeks. Vertigo for a few days. Diarrhœa four weeks, eight to fifteen watery stools daily. Has severe pain in bowels and gall-bladder region. Is nervous and sleeps poorly. Bad dreams and hallucinations for a week. Legs are swollen. Dermatitis of hands, arms, face, and vulva is present. (Figs. 5 and 6.)

On physical examination, all the internal organs appear normal. Pulse, 92. Temperature, 101° F. Respiration, 24. Gastric secretion is normal. Urine, regular.

Treatment.—Paregoric *p. r. n.* for pain. Vaginal douche of solution of bicarbonate of sodium. Calcium sulphide, a grain before the morning, noon, and night meals.

Diet.—Meats, toast, crackers, milk, and eggs every three hours. The results here were prompt, and the patient was feeling well in two weeks. On April 15, 1912, she reported well, and had gained 25 pounds in weight.

Medicine

A LECTURE ON THE PRESENT STATUS OF EPIDEMIC POLIOMYELITIS *

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There is presented to this country, for the first time in its written medical history, the serious and important problem of having within its borders, perhaps for an indefinite period, the very severe disease of epidemic poliomyelitis. It behooves the medical profession, therefore, to utilize such knowledge regarding it as we now possess, and to add to that knowledge by every possible means. Epidemic poliomyelitis still prevails among us, and, though it is perhaps less prevalent than it was three or four years ago, it has still to be controlled. While considerable knowledge has already been gained, and this knowledge, fortunately, is now being so focused that there is hope of employing effective measures of prevention, still we are not in possession of means that suffice to bring the disease under control in individual cases after it has once been established.

It is an obvious truism, in any disease, that prevention is better than cure; but in the diseases for which there is no specific cure efforts should and must be focused primarily upon their prevention. And I believe that knowledge of the disease under consideration has advanced so far, especially as regards its nature and mode of dissemination, that the hope of prevention is justified, provided a sufficiently serious outlook upon it by the public and by the medical profession can be secured, and provided those means that are indicated for its prevention are put into active operation.

Since the summer of 1907 epidemic poliomyelitis has extended from the Atlantic seaboard, where it first appeared, throughout the length and breadth of this country. At its beginning it found the medical profession more or less unprepared for its identification. In many instances the disease was not recognized at all for what it was. Not a few cases came to my attention, in 1908, in which the disease had been supposed to be an unusual example of epidemic

* Delivered (by invitation) before the South Side Branch of the Chicago Medical Society.

cerebrospinal meningitis. This, at first sight, makes the impression of being a very serious mistake. It is not, however, such a serious blunder as it appears to be, for the reason that the two diseases have a considerable similarity in some of their prominent clinical signs, so that it was natural enough for physicians unacquainted with epidemic poliomyelitis, which had, indeed, hardly been described in text-books, to confound it with the meningitic disease with which they had become only too familiar within the last few years.

In Europe, and particularly in Scandinavian countries, on the other hand, the clinical types of the disease had come to be quite sharply distinguished from those of cerebrospinal meningitis, with which also it was confused in the early period; and observant and incisive clinicians had made out not only that it appears in the classical form or paralytic type of poliomyelitis, but also as a type closely simulating meningitis—one to which we now refer as the meningitic form of poliomyelitis. They made out, further, that an aberrant type of great importance and very difficult of recognition also occurred, which is now denominated abortive. The idea of the existence of an abortive form of poliomyelitis was received in general with skepticism. There is, however, no longer any doubt about it, and proof of its existence is readily brought, both by clinical methods at the bedside, to which I shall allude, and also by laboratory tests which are quite convincing in character. We must, therefore, recognize epidemic poliomyelitis as a kind of generic name, including frank examples of the paralytic disease and examples of the disease which do not eventuate in paralysis at all, and which at first seem quite different from the affection that is associated with such extensive injury of the central nervous system as to bring about extensive paralysis. This discrepancy has happily been cleared up by a more accurate and detailed study of the pathology of the disease—not, indeed, primarily the pathology of the human disease as much as the pathology of the experimental disease in the monkey, which, in all essential respects, reproduces the human affection.

Up to 1909 epidemic poliomyelitis had never been transferred to animals by inoculation. Many attempts had been made, but all had failed, and the reason for this failure is now clear. Efforts had been made to transfer the disease to animals that are far removed from

the human species, and these animals are probably not subject to the disease. There is a single exception to this rule, which I shall mention because it serves to indicate that under extraordinary circumstances the infection may be transferred to young rabbits, in which it causes death, but never, apparently, paralysis. We have learned in recent years that certain diseases which seemed to be confined to human beings, and which could not be transferred to the ordinary lower animals, can be inoculated into monkeys. The most notable instance for the present consideration relates to the successful employment of monkeys in the study of syphilis; and you are aware how rapidly our knowledge of syphilis has grown since Metchnikoff first transferred the disease to monkeys—first to the higher monkeys, and then to the lower ones. The argument is not affected by the fact, since adequately demonstrated, that rabbits and some other animals acquire forms of inoculation syphilis. Now, it is easily possible to infect monkeys, particularly the monkeys of the Old World, and less readily those of the New World, with the virus of poliomyelitis, a fact in itself significant when you recall that the Old World monkeys are less remote from the human species than the New World monkeys. Monkeys probably never contract poliomyelitis under natural conditions, and in order to infect them it is necessary to overcome, by means of a suitable method, the external defences which these animals possess against the infection. Thus it is necessary to bring the virus of the disease into very close association with the central nervous system of the animals. It is indeed possible to make immediate transfer of the disease to monkeys by other channels than those of the nervous system itself, as, for example, by injection into the peritoneal cavity of material taken from the spinal cord of a patient, and it was in this way that Landsteiner and Popper originally succeeded in first producing the experimental disease. But this mode of transfer can not be continued. In order to secure further successful inoculation, a method must be employed by which the virus is brought into immediate relationship with the nervous centres, and this is achieved by introducing the material from the spinal cord directly into the brain of the monkeys, which is readily accomplished under anæsthesia by inoculation through a small trephine opening in the skull. What happens now? An incubation period elapses, varying from three

or four days to thirty, and averaging generally about eight or nine days, during which the animals are perfectly well, when suddenly symptoms appear. These may merely be symptoms of ordinary ill-health which precede the paralysis by a day or a few hours, or the first indications of sickness on the part of the animals may be the sudden appearance of paralysis. I mention this because in human cases the symptoms of paralysis come on sometimes without any previous obvious condition of illness, and at other times after only a few hours or several days of illness. I wish merely to point out that there exists a close relationship between the incubation period in the infected monkey and what would be the incubation period in the human beings, provided we were able to discover it.

It is further found that not only can the inoculations of monkeys be carried on serially from one animal to another through an indefinite number of monkeys, but that also the various types of the disease we have come to recognize clinically in human beings are reproduced in the monkey. There is, however, one striking difference in the effects on monkeys of the experimentally-produced disease and in the effects of the disease occurring spontaneously in human beings, and luckily it is a happy difference. When the poliomyelitic virus has once become established in monkeys, it produces a highly fatal form of the affection. At first, when the virus is transferred from human beings to the monkey, a certain number of the latter tend to recover from the disease; perhaps only half die and the other half survive. But after the virus has become adapted to the monkey, practically all of these inoculated develop paralysis and die. Fortunately, there is nothing comparable to this in the human affection; but this fact in itself is illuminating, since it indicates that in the successive transfer of the virus from monkey to monkey a modification occurs through which a more active virus is produced, better suited to the organism of the monkey than was the original human strain. We may imagine that a somewhat analogous change takes place in the virus in the successive transfers from one human being to another occurring spontaneously in the course of large epidemic spreads of the disease. Experiments have, of course, not been made to ascertain whether this altered virus has lost its virulence for human beings, but it is fair to assume that it probably has not retained its potency unaltered, and that it has lost a certain power to infect them. This is deduced

from properties known to be common to many parasitic micro-organisms.

The disease seems to appear oftentimes in a highly mysterious manner. It is exceedingly difficult to get physicians, and especially those who have not passed through a severe epidemic of it, to realize that epidemic poliomyelitis is a contagious disease. The manner of spread appears to be different from that of the highly contagious diseases with which we are more familiar. Perhaps it may help to consider for a moment the contagiousness of poliomyelitis, as we consider the relative contagiousness of measles and scarlet fever. Between them there is wide disparity. Every person is subject to measles, while it often happens with scarlet fever that of a group of persons exposed to the infection perhaps only a single one will acquire it, and others equally exposed will prove resistant, while, again, examples arise in which in a given group or family there will be multiple cases of the disease, namely, three or four, five or six or seven, appearing sometimes almost simultaneously, and suggesting, therefore, a common source and period of infection—while sometimes the interval between cases is so long as to indicate transference from one person in the group to another. These are matters of common observation and are true, too, of epidemic poliomyelitis; but yet the impression made by it is that of a disease possessing a low degree of contagiousness, particularly if attention is restricted to cases coming under one individual's notice rather than to the prevalence of the disease as a whole.

One of the duties which I have set before myself this evening is to try to convince you that the evidence of contagion in this disease is strong, and then to point out to you what the probable manner of the contagion is, in order that effective practical measures of control may be instituted. I shall, to begin with, ask you to permit me to describe briefly the pathology of the disease. Many of you are doubtless already familiar with it, but I shall assume that you are not, and I shall tell you what I conceive the pathology to be, as gleaned from a study both of the human and the monkey diseases. And the importance of the pathology in this connection arises from the fact that it assists materially to explain the varieties of the clinical manifestations, while it indicates the nature and the mode of the infection.

If you examine the spinal cord of a fatal human case, three points

especially will claim your attention. The first is that the meninges show cellular infiltration. This cellular collection is not in the nature of an exudation similar to that of ordinary acute inflammation. There is no visible exudate upon the surface of the cord; in that respect the conditions differ entirely from the appearance presented in epidemic meningitis, for example. The new cells are contained within the interstices of the tissues, and, while the infiltration is widely distributed, it is most marked and obvious about the blood-vessels, and those in particular that enter the anterior fissure to carry the blood and convey it away from the anterior gray matter. Surrounding both arteries and veins in this situation, there are accumulations of small cells of the nature of lymphocytes that extend or follow the vessels into the substance of the white and gray matter. The accumulations are so massive that they impede, to a certain extent, the entrance of the blood into, and the exit of blood from, the cord. In addition to this, and often extending out from the perivascular infiltrations, similar lymphoid cells pass into the interstitial tissue between the nerve-cells. The nerve-cells in parts of the cord in which this infiltration occurs may not be greatly altered. In certain situations, however, in the fatal human cases especially, the nerve-cells are altered, and the injury is expressed by common degeneration, by actual death or necrosis of the cells, and by the necrotic cells becoming invaded by phagocytes—neurophages, so-called—which undertake to carry them away. What I seek to impress upon you is this: that in fatal cases of the disease there is a degree of involvement of the meninges sufficient to explain the symptoms that occur and to constitute the cause of the meningeal type of the disease. It is, hence, a fair inference that in the nonfatal cases which present symptoms of meningeal irritation, without paralysis, the chief cellular process is confined to the meninges. Since, moreover, there tends to occur a wide involvement of the circulatory nutritive apparatus, which may greatly exceed the visible damage done to the nerve-cells, it both accompanies the damage to the nerve-cells and helps to explain its origin. The injury to the nerve-cells is of two degrees: in one the destruction is of such a character that the cells may recover, and in the other it is so great that they surely die. Two factors operate to produce these effects, namely, impaired circulation and nutrition, and toxic action of the specific virus.

Every one who has observed a considerable number of cases of poliomyelitis knows that in even the severely paralyzed cases, which do not terminate fatally, there is often much greater degree of paralysis at the beginning of the disease than there is at the end. In other words, the amount of improvement that can take place is great. It not infrequently happens that cases with all the extremities and the back and neck paralyzed make satisfactory recoveries. It is indeed difficult or impossible to predict over how long a period improvement may take place. It continues for months and sometimes for years. This fact is perfectly comprehensible in view of the pathological conditions I have described. The damage is not necessarily permanent. It may be due to temporary impediments in the circulation, or to faults in nutrition, both of which can be recovered from; and it is not a damage necessarily due to destruction of nerve-cells, which cannot be recovered from.

By using the monkey we are enabled to observe the disease in its whole evolution. We can study what occurs before any symptoms appear; we can study what happens at any stage of the symptoms; and we can study what happens in the process of resolution of the disease that leads to improvement and recovery. The impression that I have gained from the study of the experimental disease is that the obvious symptoms do not begin, at least in many instances, with the destruction of nerve-cells, but with the interstitial involvement of tissues, blood-vessels, and lymphatics, which is followed, secondarily, by injury to the nerve-cells. It is still an undecided question whether there may not be instances in which the virus of the disease, having an especial affinity for nerve-cells, injures them early and extensively, independently of severe involvement of other tissues. I still believe this to be the exception, and the other phenomena the rule. I emphasize this fact because it does account for the clinical course of so many cases of the disease, and because it sheds a hopeful light upon some possible specific, therapeutic method of attack upon the disease which I trust the future will provide. If injury were so quickly and severely inflicted upon the nerve-cells, the outlook for therapeutic success would be small indeed; but, since such great improvement takes place spontaneously, it would seem that the main pathology of the disease is as I have tried to represent it.

I shall now proceed to a consideration of what I shall call the

pathogenesis of the affection; that is to say, the series of changes that take place that lead to the particular pathological conditions I have described.

We have learned, as many of you know, that the cause of poliomyelitis is a microörganism belonging to a class so small that we have not yet been able to see them. To one who is not familiar with the fact that living objects may be too small to be rendered visible, even after magnification with the most powerful microscope, this is a somewhat astonishing statement. We have, after all, to think of the microscope as a mere instrument, employed and invented without reference to the ultimate size of living objects. Fortunately, in the past, it has seemed to bring into view bacteria and protozoa as ordinarily considered. On the whole, it would be quite an extraordinary piece of good luck if we had succeeded in this century in so perfecting the microscope that it would suffice to show ultimate living matter; as a matter of fact, we have no reason for believing that the instrument will show all living objects that are causes of disease. There is, then, a class of microörganisms, producing serious diseases in animals and man, which are below the limit of visibility, so far as the power of magnification of our present microscopes is concerned; and, indeed, so small that it may be considered doubtful whether we shall ever perfect an instrument that will bring them into direct view. No object smaller than the smallest ray of light that affects the human retina can be seen, and by indirect means it has been proved that some of these objects, capable of producing serious disease, are below this size-limit. It is, of course, conceivable that an instrument may be discovered that will make these objects large enough to be seen, if not directly, at least indirectly; but at present we do not possess such an instrument. And yet the proof is, as I view it, incontrovertible that such living parasites exist. A proof is as follows: We are acquainted with fluids containing particles that can not be seen, that pass through filters possessing pores too small to be seen, of which the minutest quantity is capable of producing the disease. In some instances the millionth part of a cubic centimetre, when introduced into the body of an animal, causes disease. A similar quantity of fluid taken from these animals, when introduced into still other animals, again produces the disease; and such a series of

inoculations may be continued indefinitely. We know nothing except living matter, capable of multiplication, that produces such effects.

The virus of poliomyelitis has now passed through many generations of monkeys, and has rather increased than diminished in potency. It grows best in the central nervous system, but it is not confined to it. The development in the central nervous system is the chief incident of the disease, but as the virus exists elsewhere, so do we find lesions in other organs. Thus far the virus has been found, outside the central nervous system, in certain lymph-glands only; in some amount it will be found to be present in the organs generally. What is lacking is a suitable method of demonstration more practical than animal inoculation.

Its chief affinity, outside the central nervous system, is for the lymphatic tissues of the body, which are affected at the same time that the lesions appear in the central nervous system. There results a proliferation of the cells of the glands that increases their size, not so greatly, however, as to make them obvious externally, and yet so definitely that when the lymphatic tissues are examined post mortem, particularly those of the abdominal cavity and intestine, but also the superficial glands and the spleen, this becomes at once patent. The proliferation affects chiefly the germinal centres of the lymphatic tissue, in which a degree of cellular degeneration and leucocytic infiltration is observed. The liver also shows alterations consisting of lymphoid infiltrations, degeneration, and even a recent cirrhosis, which I take not to be permanent. I mention this to illustrate the point that the effects of the disease are not confined to the central nervous system.

The cause of the disease, in order that it may survive, and in order that it may infect other individuals, has not only to get into and multiply in the central nervous system or in other parts of the body, but it has also to escape from the body. It is indeed quite as important to find out, in any infectious disease, how the germ leaves as how in the first instance it is taken into the human body. It has developed originally from the study of the experimental disease in the monkey that the virus, when deposited in the central nervous system, tends to leave the body not by way of the ordinary excretions, but chiefly, if not exclusively, by means of the nasal and, perhaps,

pharyngeal mucosa. This important fact can be most satisfactorily and convincingly demonstrated in monkeys, for the reason that the virus is introduced in a way—by intracerebral injection—that precludes the possibility of these membranes having become primarily infected. Thus it happens that when the virus is introduced into the brain by means of a trephine opening it is found some days later in the nasal mucosa of the animal when it dies or is killed.

It has been repeatedly shown that there is a regular discharge of the virus from the upper respiratory tract; and, conversely, it has also been found that the virus can enter the nervous system by way of the nasal mucosa. This route is indeed the next most effectual mode of producing artificial inoculation to the direct intracerebral one. So the virus has been proven not only to have escaped from, but also to have entered the body by, the nasal passages. This is not altogether an extraordinary fact when you recall the very small distance that separates the upper nasal passages from the membranes of the brain. The ethmoid plate is interposed between the two, and the olfactory filaments which connect the mucous membrane of the nose with the brain are surrounded by prolongations from these membranes and pierce the plate. Within the lymph-spaces of these prolongations a channel is afforded for the circulation of the virus. It has also been shown in monkeys—and this is a very important consideration—that not only does the virus circulate in this manner, but that it has a remarkable power of survival in the mucous membranes. Under ordinary circumstances, the virus disappears from the central nervous system of inoculated monkeys in about three weeks, which is about the period of its persistence in the nervous system of human beings, so far as is now known. But sometimes in monkeys it persists for several weeks or even months. We may view this phenomenon, with which there is at the moment no exact counterpart known in human cases, as equivalent to the production of microbe carriers in such diseases as typhoid fever, diphtheria, cerebrospinal meningitis, and many others. It will, on the whole, be remarkable if such occasional chronic carriers of the virus of poliomyelitis are not discovered. The importance of the mode of infection outlined is appreciated immediately in that its recognition provides a tangible basis upon which to erect measures for prevention of the spread of the disease. But it goes even further than this, and explains the series of phenomena

which I described as the pathogenesis of the affection. If the virus first sets up an interstitial inflammation of the membranes and their contained vessels, this mode of access would supply precisely the favorable conditions for plantation within the meninges.

If we now turn to the human disease, and ask to what extent these experimental observations have been confirmed on human beings, I should say that the answer is that they have been confirmed in large measure. We are confronted, therefore, now with the interesting fact, that, so far as these basic features are concerned, we have learned in two or three years vastly more from the study of inoculated monkeys than from the observations of human cases of several decades.

It has been shown recently in human cases of spontaneous poliomyelitis that the virus can be recovered from the mucous membrane of the nose and throat. During the last summer there were taken into the hospital of the Rockefeller Institute for Medical Research about eighty cases of poliomyelitis. Poliomyelitis was not epidemic in New York last year, yet there were probably several hundred cases of the disease there. The summer outbreak also supplied about ten autopsies upon fatal cases. It was possible, in most instances, to secure tissues from the nose and throat for purpose of inoculation. Portions of other organs were also tested for the presence of the virus by inoculation. The virus was demonstrated in every instance in tonsils, pharyngeal and nasal mucosa, and in a few instances in the mesenteric lymphatic nodes. Thus far it has not been detected in the other organs. Its relation to them is for the moment uncertain. It can scarcely be conceived not to reach them, but whether it has been destroyed in these we do not know. The injurious effects in the liver and lymphatic tissues which I have described may, of course, be attributed to some toxic product of the ultramicroscopic parasite, which is easily imaginable, but actually unknown at present. It follows, therefore, that in man, as in the monkey, the virus of poliomyelitis has an affinity for the nasal mucous membrane; and there is strong presumptive evidence that the upper respiratory tract is, in man, the source of infection by and elimination of the virus.

Although epidemic poliomyelitis has not the high degree of contagiousness of measles, or even of scarlet fever, yet it is well attested that there are healthy persons who may carry the infection. There

is hardly a disease known that furnishes better evidence of the existence of healthy intermediaries than epidemic poliomyelitis. The resistance to external influences of the virus is such that it can conceivably be carried for a time on the clothes or hands, and other objects, as well as upon the nasal and buccal membranes.

Certain highly contagious diseases are caused by viruses which, fortunately, are not highly resistant microörganisms. Measles is a good example of this. The cause does not survive well apart from the actively-infected person. The virus of poliomyelitis, on the other hand, happens to be one which, unluckily, has a high degree of resistance. It can live for months in a dry state. It can be kept alive at the ice-box temperature indefinitely. It withstands chemicals well. It will live for an indefinite period in weak carbolic acid. In other words, apart from infected animals, it presents characteristics of a highly resistant microörganism; and yet we have almost no knowledge that indicates that the disease is propagated otherwise than by human agency. Wherever and whenever the disease appears in epidemic form it has been observed to follow routes of human travel; that is, wherever the human carriers go, there the disease is implanted. It passes from one community and from one hamlet to another. At its initial appearance the cases are sporadic, and, as such, are connected often with difficulty or by no common bond. Because of this irregular form of distribution, and because the disease sometimes appears as single cases for a period before the epidemic arises, and because epidemics may fail to follow in the wake of single cases, it has been suggested that some other means of transportation than the human agency exists. It has, indeed, been suggested that the disease occurs naturally among domestic animals, and is only incidentally and accidentally transferred to human beings. But no such animal reservoir of the infection has thus far been detected. The fact that the experimental infection is limited practically to the monkey would seem to render this possibility remote. Animals do have paralytic diseases, and they have at times been noted to be more common during the prevalence of epidemic poliomyelitis. But whenever the paralytic diseases of animals have been studied they have proved not to be epidemic poliomyelitis. There have been sent to the Rockefeller Institute a variety of specimens derived from animals suitable for inoculation, which either had been paralyzed, or were actually para-

lyzed, or were believed to be paralyzed. We have thus inoculated into monkeys nervous tissues from the dog, cat, pig, and hen, but in no instance has poliomyelitis, or anything resembling it, been produced. We have also examined, under the microscope, sections of the spinal cords from animals, without finding any lesions similar to those of poliomyelitis in man and the monkey. The further suggestion has been made that insects may act as carriers of this infection, in the manner that they carry malaria and yellow fever. We have paid considerable attention to this subject. It is possible for the domestic fly to carry the virus on their bodies for several days, and the virus is able, also, to remain alive for some hours within their viscera; but this means merely that the virus itself is highly resistant, and flies may play a part as passive contaminators with this virus that may conceivably reach a person in a manner suitable to produce infection. The observation does not justify any more far-reaching deduction. Whether still other insects can perform a more active part in distributing the virus does not appear. Such tests as we have made with mosquitoes do not support the idea. Thus we return to the original idea propounded, namely, that not only is the victim of the disease the human being, but, with our present knowledge, we must believe that the source of dissemination is the sick human being and the well one who comes into intimate association with the sick. Among human beings, the most dangerous, probably, are those who suffer abortive attacks of the disease; and hence it is highly important that we learn to recognize these cases so as to be able to take preventive measures accordingly.

Admitting the conception of the disease outlined, we can readily follow the measures to be employed for its prevention. They are similar to those practised in diphtheria, scarlet fever, and all diseases in which respiratory infection is paramount. There should be strict separation of the sick and well. There must be destruction of the discharges which contain the virus; and a sufficient length of time must be allowed for isolation to make it at least highly probable that the infectious agent has disappeared from the nasal and buccal secretions. This period is at present based upon imperfect data; but experience indicates three or four weeks as a proper time. Although the virus of poliomyelitis is highly resistant, it is still subject to chemical destruction. Some of the destructive chemicals can be

applied to the mucous membranes. Among them are hydrogen peroxide and menthol; but doubtless other similar substances are more or less effective. Whether they actually accomplish destruction of the virus on the mucous membrane, as they do in the test-tube, is not known; probably they are less efficient there. Too much faith should not be placed in them. I believe that chief reliance should be placed on cleanliness of the hands, the face, etc., the destruction of the discharges, and the removal of the dangers of dust accumulation after the sick has been removed from the room, etc., and such other common measures as you are all familiar with.

One final point: Have advances been made looking towards the therapeutic control of the disease? We have learned that recovery from the disease is produced by immunity reactions, just as recovery from many of the infectious diseases is thus produced. But in epidemic poliomyelitis immunity principles can be demonstrated in the blood, where they persist for a long period. How long they persist nobody knows, but the duration is surely for years. Thus one attack of poliomyelitis is insurance against a second one. These immunity principles can be used passively by an injection into an infected monkey so as to produce a degree of increased resistance to infection. They have not yet been successfully invoked to cure the developed disease or to prevent its onset after inoculation, when its use is deferred for twenty-four hours.

In the therapeutic treatment of the disease it has been shown that the drug known as hexamethylenamin, or urotropin, is readily secreted in the cerebrospinal fluid, and it has some power, when administered to monkeys simultaneously with the inoculation, either to prolong the incubation period of the disease or actually to prevent its development altogether. The drug, on the whole, however, is not very efficient. Its value is not great, and after paralysis has set in it has no power to alter the course. The suggestion may be entertained of employing it early to reduce, possibly, the severity of the attack in human beings; but here the protean nature of the disease, which at times is mild and at times severe, will make it very difficult to decide upon its real value. It may further be thought of as a prophylactic to be administered to children who have been intimately exposed to a case of poliomyelitis, but who show no signs of acquiring it. Here, too, the degree of its action, if any at all is exerted, will be

difficult to gauge, since multiple cases of infection are few, and solitary cases are many.

The subject of the therapeutic control of this important disease is now before the world, since the ease and certainty with which it can be caused in monkeys afford ample opportunity for the experimental pharmacologist and pathologist.

I believe that the subject is full of promise for the future. What we have already learned offers, I think, the possibility of control over the disease by prevention. I am hopeful, indeed, that, before the experimental investigations here outlined are concluded, there may have been achieved that most welcome of all accomplishments, the therapeutic control of the disease. This, however, is in the nature of a prophecy and is not a fact.

BERIBERI AND ITS PROPHYLAXIS

BY VICTOR G. HEISER, M.D.
Director of Health for the Philippine Islands

Beriberi in the Orient may be said to be what yellow fever was in the southern part of the United States, the West Indies, and South America before the discovery of the manner in which the disease was transmitted, only beriberi is very much more destructive to life and responsible for a vastly larger number of deaths. Crews of vessels are frequently disabled, large public works are often interrupted, the operation of lighthouses rendered difficult; prisons, insane hospitals, etc., have high sick rates and mortality reports, all because beriberi has been permitted to proceed in its course without let or hindrance. In the Philippines, where there is a population of some seven millions, it is established that there have been, approximately, 5,000 deaths annually from beriberi.

Competent observers figure that the Orient has a population of, at least, fifty millions, who subsist principally on polished rice, and as there are about two millions of people in the Philippines who use polished rice as a staple article of diet, and if the number of deaths from beriberi is 5,000 annually, it may be roughly estimated that the deaths due to beriberi in the Orient number, at least, 100,000 annually. If each death represents but three cases of persons seriously ill with beriberi, it will be apparent that the proportion of pain and suffering, the financial burden, and loss of human life imposed by this malady is stupendous.

Any measure which has for its object the improvement of this state of affairs is well worthy of the best thought and attention that can be applied to it. Theories with regard to the etiology of beriberi, up to a short time ago, were legion. Recently, however, it was observed that the Tamils of the Straits Settlements did not suffer from beriberi, in spite of using rice as a staple article of diet. On further investigation it was found that the rice which they used was boiled before being husked. Fletcher, in order to test this matter

in a more or less scientific way, placed the inmates of an insane asylum at Kuala Lupor into two groups of 123 each, in separate buildings. The first group received a good quality of polished rice; and 43 cases and 18 deaths from beriberi occurred among them. The other group lived under exactly the same conditions, with the exception that they received the kind of rice which it was customary for the Tamils to use, and no cases of beriberi occurred among them. The inmates of the two buildings were then changed, the group in building No. 1 being transferred to No. 2, and *vice versa*. It was hoped by this means to test the matter of infection as a means of transmitting the disease. The persons who originally subsisted upon polished rice were given the same form of rice, and the beriberi continued to occur among them just the same; the insane in the other house were given the rice ordinarily eaten by the Tamils, and, although the disease had been present in the building, no case of beriberi occurred among them.

This observation appeared so important that two investigators, Fraser and Stanton, were sent out by the Colonial Office of the British Government to study this matter more thoroughly. In view of the fact that the rice eaten by the Tamils was boiled before being used, the inference was natural that some form of bacterial poison generated in the rice or in the rice husks was destroyed by boiling; that perhaps the rice husks themselves contained some chemical substance which neutralized the poisons which the rice might contain. A long series of experiments was made to test these hypotheses, but no organism could be found, nor could any substance be isolated. These workers then observed that, upon making microscopical sections of rice grains, the arrangement of the cells of the outer portion of the grains differed considerably from that of the inner portion. Upon chemical analysis it was found that the outer surface was particularly rich in phosphorus pentoxide, while the inner portion of the rice grain contained only minute amounts of this substance. An examination of the varieties of rice on the market then showed that highly-polished rice, or, as it is commonly known in the Orient, Siam No. 1, had so much of the coating removed that very little phosphorus pentoxide remained, while the unpolished kinds, or those which had only very slight polishing and cleaning, contained relatively large amounts of phosphorus pentoxide.

A series of experiments on fowl was then conducted. One group of chickens was fed on polished rice, and another group on unpolished rice, and it was soon noticed that all the chickens that were fed entirely on polished rice developed polyneuritis, while those fed upon unpolished rice remained in good health. The experiment was then reversed, the polished rice group being fed on unpolished rice, and *vice versa.* The chickens suffering from polyneuritis soon recovered, and in about the same length of time the chickens that had heretofore remained well developed polyneuritis. They then fed polished rice to another set of chickens, and, in addition, a small quantity of rice polishings; these chickens did not develop the polyneuritis. Other polyneuritic chickens fed on rice polishings as a curative soon recovered. Upon these observations becoming public, a controversy arose, in which it was asserted that polyneuritis in chickens was not the same as beriberi in man.

While these experiments were being conducted in the Federated Malay States, Aaron was conducting similar experiments in the Philippines, and reached practically the same conclusions as Fraser and Stanton. Soon after the first experiments on chickens had been made, Fraser and Stanton had an excellent chance to test the polished-rice theory on man. A new railroad was to be built in the interior of the Federated Malay States and Fraser had an opportunity of selecting 250 of the laborers who were to work on its construction. They satisfied themselves that these men were not afflicted with beriberi. The laborers were then taken into the interior and they began the construction work toward the coast. The site of the early operations was considered to be virgin territory. The men were divided into two groups of 125 each. The first group subsisted on polished rice and the second on unpolished rice as a staple article of diet. In about 60 days typical symptoms of beriberi appeared among the laborers who were eating polished rice, while the group that was using unpolished rice remained entirely well. This was permitted to continue for some time. The laborers mingled freely and had everything in common, with the exception of their food. They exchanged houses, wore one another's clothing, slept in one another's beds, all with the idea of transferring the infection, but no cases of beriberi occurred among those who were eating unpolished rice. The food was then reversed. Those who were eating polished rice were given

unpolished rice, and in a short time beriberi disappeared completely from among them; and between the fiftieth and sixtieth day, many of those who were now taking the polished rice were suffering with beriberi.

Further work in connection with the chemical analysis of rice was undertaken by Fraser and Stanton, and Aaron, and they determined, independently, that any rice which contained four-tenths of one per cent. of phosphorus pentoxide did not cause beriberi, while rice containing less than this amount of phosphorus pentoxide, when used as a staple article of diet, invariably produced the disease. All of these observers, however, stated that they were not prepared to say that beriberi was due to the lack of phosphorus pentoxide.

ELIMINATION OF BERIBERI IN THE PHILIPPINE ISLANDS

The next test of the work, along practical lines and upon a very large scale, was done by the Bureau of Health in the Philippine Islands. At the Culion Leper Colony the monthly death-rate prior to the time that unpolished rice was introduced was as follows, based on an average population of 1,537: 1909—February, 39; March, 54; April, 52; May, 47; June, 48; July, 57; August, 61; September, 65; October, 43; November, 80; December, 188. 1910—January, 164.

Of this number, approximately eighty per cent. were due to beriberi. In February, 1910, unpolished rice was introduced, and the deaths, by months, for that period, were as follows, among an average population of 1,952: February, 66; March, 36; April, 29; May, 22; June, 27; July, 15; August, 24; September, 12; October, 13; November, 15; December, 58; January, 52.[1]

These results were so striking that an order was issued by the Governor-General of the Philippine Islands prohibiting the use of polished rice in all public institutions. Before this order was issued there were, approximately, 600 deaths per annum from beriberi among persons who were supported by the Government. Since that time only 6 deaths from beriberi have been reported among them, and these were cases that either came into Government care in a critical condition, or were, for unavoidable reasons, fed on polished rice.

[1] Much of this increase was due to an acute outbreak of dysentery.

EDUCATION NECESSARY TO ELIMINATE THE DISEASE

While it has not yet been definitely proven whether faulty nutrition is the only cause of beriberi, there is sufficient evidence on hand to say, with a reasonable degree of certainty, that the ravages of this disease can be greatly reduced among persons whose staple article of diet is polished rice.

Cases of beriberi are occasionally reported where it is most difficult to trace the direct origin; it must be remembered that there is still considerable difference of opinion as to just what symptoms should be regarded as beriberi. Ship fever, scurvy, poisonings due to arsenic, alcohol, and similar causes, have been frequently diagnosed as beriberi. There is now a large amount of data available from numerous countries in the Orient, and it may be said that it is generally accepted among the best medical men of the Far East that the bulk of the cases of beriberi is due to the lack of some substance not contained in polished rice.

With this great weapon now in the hands of medical men, it only remains to educate the masses and to bring pressure to bear upon rice-mill owners to prepare a less highly polished article. As it is not deemed practicable to prohibit the use of polished rice under a pure food law, it is, therefore, proposed to attack this problem in the Philippines by placing a heavy tax upon polished rice, unpolished rice being untaxed. This would practically force the use of unpolished rice among the masses, and Europeans and others not so dependent on rice as an article of food would not be deprived of using the polished variety to which they are accustomed, and in this way their opposition can be overcome and their coöperation secured.

LARGE SYPHILITIC TUMOR OF THE LIVER

BY J. GARLAND SHERRILL, A.M., M.D.

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Syphilitic tumor of the liver occurs with sufficient rarity to make the reports of isolated cases of considerable interest, and therein may be found the principal reason for recording the following:

On March 14, 1911, Mr. S., aged 36, came to me with a very large growth in the upper abdomen, with the following history: About nine years ago he had a syphilitic genital sore for which he was treated a short time, *i.e.*, only until disappearance of the symptoms. He then remained comparatively well until eighteen months previous to consulting me, at which time he observed an unusual fulness in the abdomen. This was unaccompanied by either nausea or vomiting, and gave him little discomfort. No blood was observed in his stools, his bowels moved regularly, his urine remained normal, and during this time his appetite was unimpaired; in fact, he has been a voracious eater.

Six months after the first appearance of this abdominal mass a cœliotomy was performed in another city. The surgeon found a growth upon the left half of the liver, with a broad base, about three inches in diameter, and abandoned the operation, believing the neoplasm to be cancerous. Following this operative intervention, growth of the mass has been steady, but, notwithstanding the presence of the constantly-enlarging neoplasm, the general health of the patient has not deteriorated; on the contrary, his weight has steadily increased.

On examination of the abdomen I found a tumor extending from the ensiform cartilage downward to the umbilicus, and laterally about four and a half inches on each side of the median line. In the median line the mass gave to the abdomen a marked prominence, as will be observed in the illustration herewith presented (Fig. 1). This mass moved with the liver in excursions of respiration, was dull on percussion and slightly nodular; pressure over the tumor caused the patient but little discomfort. He complained, however, of some interference with respiration. Laterally the mass showed slight mobility. Other portions of the abdomen seemed to be normal, no ascites being present, nor was there any marked enlargement of the superficial abdominal veins. Analysis of the urine showed this secretion to be normal.

The man presented none of the usual glandular enlargements of syphilis, but inspection of his buccal cavity showed a small ulcer on the mucosa just at the junction of the hard and soft palates—a typical syphilitic lesion.

Under the circumstances I considered this a rare and interesting case. Here was a man who had been operated upon one year previously and had been told that he could not live very long; that the

neoplasm was probably malignant. A year later he presents a much improved condition of general health, notwithstanding the persistent increase in the size of the tumor.

Among the possible causes of such a condition might be mentioned hydatid cyst, benign tumor, sarcoma, carcinoma, syphilitic granuloma of the liver. It seemed justifiable to exclude the possibility of hydatid cyst by the absence of any history of tapeworm, and from the fact that the tumor was solid and showed no tendency whatever to fluctuation. The conclusion that the neoplasm was not a sarcoma was justified by the fact that a sarcoma growing to the size reached by this tumor would have caused marked anæmia and cachexia, and certainly there would have appeared some interference with the functions of digestion and assimilation. The same may be said of carcinoma. A carcinoma reaching this size would almost certainly have been followed by marked glandular enlargement, which is of itself quite distinctive. It would appear, therefore, that the condition must be either a benign tumor or syphilitic enlargement of the liver. It is unlikely that a benign, nonsyphilitic tumor would develop to the size reached by this mass within the time which has elapsed since the growth was first discovered.

I have never before seen a syphilitic growth of the liver reach this size; in my previous experience gummata have usually been small and have caused a general enlargement of the liver rather than a circumscribed tumor. Dr. R. Hayes kindly made a Wassermann test for me in this case, which proved to be negative, and a similar report was made by Dr. Cyrus W. Field. This negative reaction, however, does not seem to contra-indicate the possibility of this growth being syphilitic, since D. M. Coplin, in an article appearing in the *Journal of the American Medical Association,* December 3, 1910, makes the statement that in three cases of tumor of the liver two showed positive and one negative Wassermann reaction. Therefore the negative reaction in this case is not a positive indication that the patient has not a syphilitic tumor of the liver.

This patient was presented to the Jefferson County (Kentucky) Medical Society about two weeks after his first visit to me, during which time he had been under active specific medication, commencing immediately after the Wassermann test was made. At that time there seemed to be a slight diminution in the size of the growth.

Fig. 1

Large syphilitic tumor of the liver.

The treatment has been continued for eight months, and the size of the mass has gradually diminished until now (November 16, 1911) it is smaller than an orange, whereas when first seen it was about the size of a large cantaloupe. It is to be hoped that a further diminution in size will take place.

Salvarsan has not, so far, been utilized in the treatment of this patient, mainly because we desired to first positively corroborate the diagnosis of syphilitic disease of the liver by the administration of mercury and iodide of potassium. The treatment employed has been daily inunctions of mercury with increasing doses of potassium iodide until the patient is taking about six drachms of the iodide daily. It is proposed later to give him the benefit of salvarsan, and carefully note the effect.

In this connection it might be well to consider the feasibility of removing large portions of the liver-tissue by surgical means. I have safely removed small sections of the liver on several occasions, but have never attempted the removal of a large tumor such as this, where the greater portion of one lobe would, of necessity, have to be sacrificed. It has always seemed to me rather easy to control hemorrhage from the blood-supply of the liver. A clamp placed about the lesser omentum at the foramen of Winslow would shut off the circulation in the portal vein and hepatic artery, and in this way entirely occlude the hepatic blood-supply. At present I am making some experiments along this line in perfecting the technic of operations upon the liver, the results of which will be published later.

I can say, however, that it is possible by the method mentioned above to render quite bloodless operations upon the liver. In this way the shock of the operation can be materially lessened and the dangers incident to hemorrhage easily overcome, and it is my hope in further experiments to determine how long a temporary occlusion of the vessels may be employed without damage to the liver-tissue.

While this article is more directly concerned with the syphilitic neoplasms of the liver, yet it is perhaps well to briefly mention the other forms of that disease which may affect this organ. The condition is met with both in acquired and congenital syphilis, and while some forms are seen in the earliest stages of the disease, we rarely meet gummata until the latter part of the second or in the third stage. Cumston, in a rather full article upon this subject which appeared

in *Annals of Surgery,* 1903, xxxvii, p. 726, says that gummatous tumors of the liver do not arise until five years have elapsed after the date of infection, or more commonly the tumor appears ten to fifteen years afterward, while Osler and others state that it is sometimes seen in the second year after infection. According to Kaufman, whom I shall quote freely, congenital or intra-uterine syphilis of the liver differs materially from acquired, and presents two forms of pathological change, which are sometimes combined:

"1. *Interstitial hepatitis, which shows a cellular infiltration and a more or less vigorous connective-tissue formation.*—In the more severe cases the organ is enlarged, hardened, and elastic, with a smooth surface. Its cut surface is smooth without glandular appearance; sometimes of a brownish color, pale, glistening, and mottled,—so-called 'firestone' liver,—especially in children that have gone to full term; while in other cases it is much darker. The older the fœtus the more marked is the connective-tissue induration. Microscopically there is a localized or diffused connective-tissue formation present, composed of round, oval, or spindle cells. From the encroachment of this new connective-tissue the secretory structure of the liver in many parts entirely disappears. The infiltration of connective-tissue formation is at the beginning between the acini and around the capillaries; in the later stages this is no longer pronounced. In some cases the glandular structure remains, the cellular infiltration following the course of the blood-vessels.

"2. *Miliary Gummata.*—Sometimes these are microscopic. In other cases they appear on the cut surface as yellowish, irregular spots or opaque granules. Infrequently large ball-like nodes present and make quite the impression of a tumor."

Occasionally the development of numerous gummata occurs, especially in the neighborhood of the hilum or adjacent parts, causing compression of the biliary passages and jaundice. The same may also occur either from interstitial new formation or pericholangitis; infrequently an atrophic cirrhosis follows this interstitial hepatitis.

The following types present in the acquired form of the disease:

"1. *A Diffuse Interstitial Connective-tissue Infiltration.*—This develops from the periphery to the interior, often resulting in very broad fibrous septa, which, when contraction occurs, draw in the upper surface and divide the liver-structure into lobules. These

masses can be sometimes felt through the abdominal wall. The form of the liver is irregular throughout. Its capsule is thickened and is bound to the neighboring structure by numerous bands or thread-like adhesions. In one portion, where a broad septum forms, the parenchyma of the liver disappears; in another disappearance of secretory structure also occurs through constriction or pressure atrophy, while the remaining parenchyma is not infrequently hypertrophied to compensate for the portion that is damaged by disease. This interstitial hepatitis, with the formation of lobules, is characteristic of lues.

"2. *Gummata.*—These inflammatory tumors are sharply circumscribed, yellowish, cheesy masses of a gummy consistency, which are surrounded by smooth connective-tissue; they are solitary or multiple, varying in size from a small pea to that of the fetal head. They are often situated deeply under a contracted discolored portion of the upper surface, which may be adherent to the surrounding organs. Seldom are they found in the deeper liver-tissue, more often near the suspensory ligament than the under surface. They differ from cancer in having a grayish periphery and a yellowish centre. Rarely they appear upon the upper surface as globular prominences, similar to those found in sarcoma and carcinoma." (Kaufman.) Necrosis and fatty degeneration are prone to occur in these growths. Under treatment absorption of the necrotic and degenerated portions occurs, and a connective-tissue formation takes its place. Healed lesions present irregular scars.

"3. *A Combination of Gummata and Hepar Lobatum Occurs.*—In this condition there are gummatous deposits accompanied by interstitial hepatitis, with fissures. In this form the liver is small from atrophy of the parenchyma due to pressure of fibrous bands."

Surgically the lesion of importance is that of gummatous granuloma, which appears either in single or multiple masses, varying from two millimetres in diameter to the size of the fetal head. Occasionally these masses undergo necrotic changes with softening, such as is seen in cases of external gummata, yet condensation of tissue is the rule, and there seems to be an effort toward repair by the formation of connective-tissue. These masses are especially prone to appear near the suspensory ligament of the liver and at the hilum, as well as along the course of the branches of the portal vein. In some cases there may be such an amount of contraction of connective-tissue that

the liver becomes separated into a number of irregular lobules to such an extent that it has been called botryoid liver (from its supposed resemblance to a bunch of grapes).

These tumors may produce enormous enlargement of the organ within a rather short time. They may or may not be accompanied by jaundice; the latter is usually absent when the growths spring from the free margin or the surface of the liver. When situated at the hilum the pressure of the growth frequently results in ascites from obstruction of the portal circulation. The patient's temperature may remain normal, or an intermittent or remittent type of fever may occur. In many cases pain is not a marked symptom, although a feeling of fulness and tenderness is often noted. In some cases there is absolutely no interference with the appetite, digestion, or general health, whereas in others there are lessening of strength and endurance, loss of weight, and a muddy complexion. When softening of the gummatous masses occurs it is often accompanied by an elevation of temperature.

Diagnosis.—In the diagnosis of these growths it is necessary to determine first that the mass is connected with the liver, as shown by its movement with that organ in respiration, as well as by the continuous line of dulness which is usually present. In rare instances the latter is interrupted by a line of tympany near the upper margin of the growth; second, it must be differentiated from other affections which produce a localized enlargement of the liver, such as mentioned previously. While, as a rule, it is easy to determine that these masses are connected with the liver, it will at times be difficult or impossible to be positive upon this point. The numerous enlargements occurring in the upper abdomen, such as distended gall-bladder, gastric, renal, suprarenal, and pancreatic growths, mesenteric and omental tumors and cysts, as well as the various forms of hepatic enlargements, require very careful study to arrive at an accurate diagnosis. It would certainly seem unwise to make a positive diagnosis of syphilitic tumor without eliciting from the patient a specific history or obtaining clinical evidence of the presence of this disease. While, as shown in this case and another one previously mentioned, a negative Wassermann reaction is not a positive evidence of the absence of syphilis, yet the presence of any such positive reaction would tend to confirm any previous suspicion. Prompt response to

the employment of mercury and the iodides should tend to confirm the other clinical findings.

Treatment.—The writer considers this condition only in rare instances to demand operative intervention, because of the well-known tendency of lesions of this character to diminish and finally disappear, following the administration of a vigorous antisyphilitic treatment; therefore, operation should only be advised after the course of treatment has shown only moderate improvement and where final disappearance of the masses does not take place. At this time the neoplasm is largely composed of fibrous tissue, and from its pressure-effects alone may cause some discomfort to the patient. If such condition presents, surgical intervention is justifiable, and from a number of cases recorded (some sixteen, as far as the writer has been able to note) operative results have been very good.

Pædiatrics

THE DANGERS OF THE UNDERFEEDING OF INFANTS

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When a healthy infant is on the breast there is little danger of underfeeding. The child will take what it requires, and if, on account of any abnormality of the mother, the supply is inadequate, the infant will quickly show by crying and by a too-frequent desire for the breast that it is not getting as much as Nature requires for its due growth and vitality. If, on the other hand, it takes too much, it will reject the excess and usually is none the worse for it.

It is with artificially-fed infants that the various dangers of feeding arise. A child may be given too much food, either in bulk or in composition, and may suffer accordingly, or it may become disturbed by taking some manifestly abnormal diet. So great is the fear of giving a child too large an amount of food, that, in the writer's opinion, many physicians, fearing this very danger, err in the opposite direction, so that infants are often more or less starved, and that at a time when on account of their rapid growth and development they especially need much food. Dr. T. M. Rotch,[1] the father of percentage feeding, says in this regard: "The management of the proteids presents the greatest difficulty. It is disastrous to give too high proteids and it is dangerous to keep them too low for too long a period. . . . Those of us who appreciate how great is the danger of high proteids have to guard against the habit of keeping them too low for so long that the nutrition of the child suffers." As a matter of fact, the extreme danger of high proteid feeding has been somewhat discounted since this was written. Rotch gave an ample diet; thus, for a child of one month he allowed eight feedings a day of 2½ ozs. each, with 3.5 per cent. of fat, 6.5 per cent. of sugar, and 1 per cent. of proteids, giving a caloric value of about 400.

In attempting to gauge the amount of food that an infant requires at any given age, the usual and most natural standard is the amount of nourishment that the child would take from its mother at that age. This has been got by weighing the baby immediately before, and again immediately after, each nursing. According to Pfeiffer (quoted by Holt) this is as follows:

At end of first week..............	10–16 ozs.	= 220–350 calories
At end of second week............	13–18 ozs.	= 286–396 calories
At end of third week..............	14–24 ozs.	= 308–528 calories
At end of fourth week............	16–26 ozs.	= 352–572 calories
Fifth to thirteenth week..........	20–34 ozs.	= 440–748 calories
Fourth to sixth month............	24–38 ozs.	= 528–836 calories
Sixth to ninth month............	30–40 ozs.	= 660–880 calories

It will be seen what a wide range is allowed by Nature in the quantity that different children may take at different ages. Thus a child at the end of the first month may take from 16 to 26 ounces, giving a variation in calories of from 352 to 572.

In any endeavors to furnish a dietary for an infant that cannot be nourished at the breast, a first axiom would appear to be that at least as much nourishment must be provided as the child would get from its mother. This works out at about 100 calories per kilo. of body weight, or about 50 calories for each pound in weight; but when the food is artificial this is scarcely sufficient, and 110 to 120 calories per kilo. of body weight is the standard more generally recognized, the extra calories being required to provide energy for the extra work of digesting the abnormal food. Heubner would put the amount at the higher figure mentioned, while Czerny and Keller believe that cow's milk and human milk are about equal in this respect.[2] Rotch's *Number 25* milk mixture, for a child of three months, gives about 600 calories, which is about 110 calories per kilo. of body weight for a child of average weight at that age,—5.5 kilos.

While it is imperative that at least a sufficient number of calories per day be provided, this by no means ends the task, as the proportions of proteins, fats and carbohydrates must also be considered. Roughly speaking, these should approach those found in human milk, although it is generally conceded that the proteins should at first be relatively low, but they may be soon increased as the infant's powers of dealing with the foreign protein grow. Mother's milk, however,

is not quite a fixed standard. The analyses by different workers vary a good deal, and as Sutherland says,[3] "Breast milk is constantly varying from day to day in the same woman, and even from hour to hour under the same conditions and diet. . . . Even at a single nursing the milk at the beginning is often different from that at the close, so that an infant at the breast obtains not only a food but a meal which may be regarded as a series of courses." It is the fat that has been shown to vary mostly under different conditions of diet and living, the important proteins remaining nearly constant. Although human milk varies only within narrow limits, a child seems to be possessed of a marvellous power of selecting what it requires from a great variety of foods introduced into its stomach. How otherwise can we explain the fact that it may grow and apparently flourish upon such divers diets as mother's milk, cow's milk (either pure, diluted, or modified in various ways), buttermilk, goat's milk, ass's milk, various proprietary foods, etc.? At the time of writing, a child, attending the Out-Patient Department of the Children's Hospital, well illustrates this point. This infant is three months old, and is of normal weight and appearance, except for a dry and healing eczema of the face which has been there for over two months. The eruption began at two weeks of age, when the child was wholly on the breast. Two weeks later the doctor weaned the infant, thinking that the mother's milk was disagreeing. Since that date the only food has been arrow-root biscuits, ground fine and given in barley water. No food has been given beyond this. The eczema is much better!

Thus, while it is believed that no food equals the mother's milk, or, in its absence, some mixture closely resembling it, it must be remembered that the infant has great inherent powers of adapting itself to a faulty diet. The food to be aimed at is the one which will give, not an occasional healthy child, but the greatest percentage of healthy children.

When an infant suffers from any alimentary disturbance, the food is usually blamed for the trouble, and properly so, no doubt, but, when it comes to the question of which constituent in the food is at fault, opinions differ from time to time. For a long time the proteins were the elements which were thought to give rise to most of the trouble, then the fat was blamed, and recently it is the milk sugar which is at the root of the disturbance. J. L. Morse[4] lately has written: "According-

ing to Finkelstein and Meyer the differences between the digestibility and availability of human and cow's milk by infants are not due to qualitative differences in the constituents of the milk. Casein causes no disturbances of digestion. Fat and sugar have no pathological action unless the digestive functions have been injured. The fat and sugar of human milk can act in the same way, if the injury to the intestine is severe enough." According to these writers, diarrhœal diseases originate in a functional weakness of the intestine, and this functional weakness is kept up and increased by fermentation." Fats, sugar and proteins are all susceptible to decomposition, and the whey may also play a part. Czerny and others have blamed chiefly the fat for the fermentation, but Finkelstein and Meyer conclude from their experiments, in which they obtained the same results with diluted whole milk as they did with skimmed milk and buttermilk, that the fermentation is not due to fat. They also found that the addition of freshly prepared casein to skimmed milk and to dilutions of whole milk, which babies with indigestion were taking, not only did not make the babies worse but apparently improved them. The thin acid green stools changed in a few days to typical light-colored and dry soap-like stools. They conclude, therefore, that casein has an anti-fermentative action and is harmless. Milk sugar must, therefore, by exclusion, be the cause of the fermentation." They urge that the principles on which the preparation of a food to combat fermentation depend are: (1) a diminution in the amount of milk sugar; (2) a diminution in the salts by diluting the whey; (3) an increase in the casein, with (4) varying and not inconsiderable amounts of fat. The food which they recommend is one in which the percentage of fat is 2.5 per cent., that of sugar only 1.5 per cent., salts 0.5 per cent., and protein 3 per cent. A quart of this mixture contains about 370 calories, and to it is soon added some dextrinized preparation of malt sugar, which is not believed to ferment so easily as does the milk sugar. Thus the pendulum has swung so far that we find recommended a protein content nearly double that of human milk. This surely is too great a swing, and Morse, who tried the method, does not appear to have been enamoured of it. It proves, however, that the infant stomach can stand even an excess of proteins, if these be administered in digestible form.

The protein content of mother's milk is essential to the life and

growth of the infant. As Dr. Cheadle says:[5] "With children, as with adults, the nitrogenous elements or proteids rank first in importance. They are used for the structure of the brain, nerve, muscle and gland. Protoplasm, the centre of life and energy in every individual cell, is formed of nitrogenous matters, and nourished out of them. Every structure in the body in which any form of force is manifested is nitrogenous. Nitrogen is indeed essential to every vital process. Deprived of it, every function of the body languishes. All vigor and power die out. . . . Deficiency of this element of nitrogenous food shows its evil mark quickly; the child's growth is interrupted; it becomes flabby and soft of muscle, pallid, feeble; vigor and vitality and the power to resist disease decline." As is well known, the rate at which the young of any animal grows is dependent, or at least is associated with, the percentage of protein in its mother's milk. Thus, at one end of the scale we have the rabbit, which gets 10.4 parts of protein in one hundred parts of mother's milk, and doubles its weight in seven days; while, at the other end, comes man, who gets about 1.6 per cent. of protein and takes 180 days to double his weight. This being the case, it seems to be a very risky thing to interfere with the protein content of a child's food for any length of time, especially during the first year of life when the growth is the most rapid.

It is often necessary in diseased conditions of the alimentary tract to cut down a child's food very much, even to the extent of giving it nothing at all or only sterilized water or barley water for a short time, but when this is done it is most necessary to remember constantly that the child is then being therapeutically starved and is in a danger zone from which it is urgent that it be removed as soon as possible. As Holt says:[6] "To continue with the very low proteids frequently leads to disturbance of nutrition which is sometimes very serious." It is dangerous to keep a child too long on an insufficient diet, and here one would venture to hint that Rotch's well-meant advice may be risky if too literally followed. He says:[7] "It is wise always to accomplish first the proper digestion of food, even if there is no gain of weight, and then, when once the infant is digesting well, to increase the amount of the percentages of the different elements." Now one often sees a child, even when on a very insufficient diet, continue to show digestive disturbances, with bad stools, etc., and yet

we must not always wait until these disappear before giving more food, or we may wait too long. As stated above, Finkelstein and Meyer found the stools of marasmic infants on milk mixtures to improve when they added casein, and J. S. Fowler [8] writes that he has often seen the substitution of undiluted for diluted milk followed by the cessation of colic and curdy stools; and this has also been the writer's experience. Great dilutions have many risks, *e.g.*, the over-filling of the stomach, and the water-logging of the child's tissues—often leading to œdema. A small concentrated meal may often be taken and digested by an ailing child when a more bulky and yet less nutritious one may be largely refused, or may disagree and be vomited.

George Newman, in a book entitled "Infant Mortality," [9] gives the results obtained at the Finsbury Infant Milk Depot, which are very instructive. The infants are fed at their homes, the milk being merely supplied at the depot. Most of them were sick when the milk was applied for. The milk mixtures are three in number and give the following analysis:

	Mixture A	Mixture B	Mixture C
Fat	2.51 per cent.	3.28 per cent.	3.86 per cent.
Proteids ...	1.24 per cent.	1.91 per cent.	2.48 per cent.
Lactose	5.49 per cent.	5.45 per cent.	5.56 per cent.

Mixture A is given to infants up to three months of age. It gives, according to our estimation, about 15 calories per ounce, and is given in quantities from 18 to 32 ozs. in the twenty-four hours, which represents about 270 to 540 calories. Modification B is given from three to six months of age. It yields about 18 calories per ounce. Modification C is used for infants of from six months to one year of age. It represents about 20.4 calories per ounce. The results of this ample feeding have been excellent, although, as already stated, most of the children were already ill when the milk was applied for, and fifty-four per cent. were under three months of age. Out of those who attended the depot for a month or more 80.5 per cent. gained on an average over half a pound in weight per month, while 19.5 per cent. gained on an average less than half a pound per month. There were thirteen deaths out of 169 infants. Three of these infants were brought in a dying condition and, excluding these, we get a death-rate of 59.1 per 1000 births. The general mortality rate for infants

for Finsbury in that year was 148.6 per 1000 births, so that the infants fed from the depot did very well indeed. They received a pure and ample diet.

CONCLUSIONS

First.—That, when it becomes necessary to feed a healthy infant artificially, whether accurate percentage methods or the more simple home modifications be employed, whether the child be put upon whole milk, modified milk, or some form of artificial food, it is necessary that the infant be given sufficient, both as regards the caloric value and the fats, sugar, salts, and, above all, the proteins, to maintain its rapid growth and general development and vitality.

Second.—When a child has temporarily to be placed upon a diet which is less than that required to keep up this growth and development, it is most urgent that this starvation *régime* be abandoned at the earliest possible moment.

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CAN WE PREVENT THE "BOTTLE-FED BABY"? *

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The physician of to-day possesses many advantages over the physician of even a decade or so ago. Much of the force of modern science is to-day directed toward the aid of the medical man. Millions of dollars are being spent annually in furnishing the sinews of war with which we may do battle against disease, retard death, and increase the efficiency and lengthen the span of human life.

But above and beyond even the power to combat ill health is the growing power to preserve good health. The physician to-day is realizing, perhaps as never before in the annals of medicine, that in very truth "an ounce of prevention is worth a pound of cure," and it is on the value of preventive rather than on remedial measures, as they touch the whole vast subject of human welfare, that I would speak to you to-day.

Scientists and philanthropists alike have recognized the value of prophylactic treatment as a race boon, and we note with pleasure the recent establishment of a million-dollar preventorium for tuberculous children, as well as the increase of hygienic devices all directed toward preventing minor diseases.

But underlying the prevention of actual disease there is a more insistent call to the true physician—a call so imperative that its echoes resound from the very beginning of human life itself. Even the modern science of eugenics, dealing as it does with the actual generation of human life, with its recently appointed college professors and its growing circle of students and disciples, does not hear nor heed this voiceless plea. What matter all precautions taken in the generation of life; what matter, even parental health, if, when a new life begins its long struggle against disease, its battle for the "survival of the fittest," it is permitted to do so unguided by parental wisdom;

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when infants are denied the ample and adequate food which Dame Nature herself, that wisest of all mothers, has provided for them, and are thus deprived of the chance of beginning life equipped with any measure of health or strength? Whether the cause be worldly influences or merely gross ignorance is immaterial, it is a fact that of all barbarous customs, of all uncivilized methods which our sometimes over-civilized modern life permits and even countenances, that of the bottle-fed baby is without any doubt or question the most barbarous and the most uncivilized. Indeed, the only parallel to this which we can find in ancient history is the infant sacrifices to the god Moloch, who demanded fresh child's flesh as a daily diet!

It has often occurred to me, as I handled the emaciated and starved form of an unnecessarily bottle-fed baby, that if our own government ever could become really paternalistic in a literal and helpful sense, that here indeed was a case where its interference might well be directed against a voluntary "slaughter of the innocents."

I ask you, my fellow practitioners, if you have, in all sincerity, given this subject sufficient thought? Have you been professor as well as physician to the young mother during the first months of her first pregnancy? Have you patiently taught her the grave importance to herself, to her child and to the human race itself, of being prepared to give her offspring nourishment from the only safe and sure source which we have ever known? Truly, the fountain of life is in the breast of the mother and yet how often does some trivial consideration cause her voluntarily to shut off this God-given supply?

I am willing to admit that it is often done in ignorance; in innumerable cases the young mother does not recognize the danger; she hears of all the "fine foods" on the market and she hears, too, of the loss of time and comfort to herself or, as I heard a young mother say recently, of her own "slavery" if she nurses her baby. And hearing all this, like Eve of old, she is tempted. She tries the advertised goods, and in an incredibly short time the baby, born healthy, is a wasted little wreck, with all its natural physical powers blighted, and if life itself be granted to it, its whole future is clouded by the shadows of that fight against actual starvation which attended the first months of its miserable little existence.

Of course this does not apply in the most remote way to those unfortunate mothers who would gladly nurse their babies but, for some

uncontrollable physical reason, are unable to do so. This brings us to the question as to what causes are "uncontrollable" and we naturally inquire to what extent can the physician overcome ordinary obstacles to normal breast feeding? I have been carefully investigating these conditions and I find that from a pathological viewpoint the prospective mother should carefully consider her own health from the first moment she recognizes her condition. Of course, there is the social side of the question to be carefully considered. No physician wishes to consign a young mother to social seclusion, or to a neglect of her simple social duties and pleasures during the early months of pregnancy, or during the months of nursing her baby. On the contrary, rational and reasonable pleasures are to be desired, but these should be taken in moderation and with due regard to the grave responsibilities which the future will bring forth.

Yet is it not an undeniable fact that undue social excitement, too much exposure of the neck and chest, as dictated by the modern evening dress, too much taxing of the nerves, the digestion and even of the brain itself—all conspire to prevent the highest efficiency in the prospective, as well as in the nursing mother? Here, too, we might counsel the young man desiring normal offspring to consider well his choice of a wife, and if possible to select for a life partner one who seems sensible enough and unselfish enough to be willing to consider the welfare of those other lives which may emanate from their own.

Naturally there are a myriad of substitutes for mother's milk, but I shall broadly assert that there is not a single one of them which will permit an infant to begin life with the same physical equipment as that which flows to it from the normal breast of a normal mother. On the contrary, most of the baby foods now on the market are actually deficient in those qualities which support life, and are laden with scurvy and rickets.

Statistics have proven that over 20 per cent. of the children born into the world die from improper feeding, which causes a long train of gastro-intestinal diseases. I have proved this many times in my own personal experience, and I cannot too strongly urge the need of enlisting all classes and all persons interested in the welfare of humanity to unite with us in the prevention of the bottle-fed baby. Ministers, doctors, nurses and women's clubs throughout the country

might well combine to make this a common cause. I would urge that lectures be given on the subject wherever possible, and that even the omnipresent moving picture machine be enlisted in this campaign against the bottle-fed baby; in fact, anything and everything that tends toward educational methods along this line must have the heartiest endorsement and co-operation of medical men and of the public generally.

As a Southern physician I have observed that most negroes have a very ample milk supply; this would seem to prove the theory that a sunny, cheerful temperament, a simple and wholesome life all combine to create ideal conditions for milk producing. During the old days of slavery, when the negroes were carefully guarded by their owners, because of their actual value, almost every mother was able to nourish at least two babies at the same time, so freely did she produce milk, and good milk, too. To-day, almost without exception, the negro woman nurses her own child and she places great stress on the value of her food supply, too.

Now, do we, in all sincerity and honesty consider the question of encouraging lacteal health as one of the main considerations in the care of the prospective mother? I feel certain, myself, that many of us really overlook this, and I realize, too, that it is a delicate subject for many reasons.

It has no doubt come to your notice as it has to mine, that at the present time, Nature has failed to care for herself by not enabling the majority of nursing mothers adequately to take care of their offspring. Each case, therefore, must be given individual study, in order to prevent the trouble from occurring at all or to relieve it when it does occur despite our efforts. First, we must remember that in the pregnant woman every organ is under high tension, and the first discord, either physical or mental, is liable to play havoc with the milk secretions. As I have said, most women select a physician soon after conception occurs, and it should be one of our first duties to urge all our patients to choose a competent obstetrician who will direct her to an easy labor and an adequate milk supply. In order to accomplish this the care should be given during the first and not during the last months of pregnancy, and the pregnant woman should be given the most careful examination, with especial attention to the blood, heart, kidneys and nervous system.

I lay special stress on the blood examination at this stage for the reason that a great many women are anæmic, and I consider anæmia one of the principal etiological factors in preventing normal milk secretions, and thus necessitating the bottle-fed baby. It is true that the pregnant woman takes on flesh, but sometimes this is at the expense of the blood supply to the fœtus. Even the blood of the so-called fat woman is often found deficient in hæmoglobin, and while such women might even have large and bulging breasts, their milk supply is usually deficient.

But it is right here that we should begin our struggle to induce a normal milk supply and to aid Nature in producing a normal infant. With a good foundation of proper hygiene, suitable food, requisite amount of exercise and rest, together with a tonic containing iron, we can in most instances avoid what I have termed the "stuffing process" so often resorted to induce milk after the child is born. When the milk of a young mother is found lacking in quantity and quality the usual routine is to order teas, meats, milk, broth, cocoa, potatoes, etc., the order being generally "to take all you can hold." Can we reasonably expect Nature to do in a few days what it would take weeks to accomplish? Granted, on the other hand, that the milk comes normally on the third day; what often takes place even then? The mother is able to produce enough milk for her baby for a few weeks only and soon requires assistance.

This subject is at last being given profound attention by scientists, and experiments are constantly being made to prove on what lactation really depends. Quite recently Miss Lane Claypon, Professor Starling, and Ott and H. Scott, of Philadephia, have all announced certain theories as to the growth of the mammary glands during pregnancy, and what affects the secretions of these glands. Mackenzie, too, has declared that pituitary extract is most active in promoting these secretions, etc. While all of these theories and experiments are of profound interest, I do not think any of them have been extensive enough to prove conclusively that a nervous element is not largely responsible for a deficient milk supply. In fact, I am sure that in many cases a strong psychological force can be brought to bear on the mother, which is entirely independent of physiological conditions. Such cases as those just mentioned need all possible encouragement, and while making consistent efforts to find out why the mother's milk supply is

deficient, the physician should never fail at the same time to give every mental suggestion in his power in order to make the mother believe that she will be able to nurse her child, instead of, as in many instances, declaring that this will not be possible, and then end by ordering one of the many artificial foods. A thorough examination should again be made, especially of the milk itself, in order to ascertain whether it is deficient in fats or proteids, and if so, proper diet and exercise to improve the condition, should be prescribed. Sometimes, too, it may be necessary to relieve the mother a little by placing the baby on one or two bottles a day, but at the same time the mother should be given careful hygienic treatment, her surroundings kept as pleasant as possible, as by these methods, as well as by judicious tonic treatment, the milk can often be brought back to the normal. I have often found that nutrolactis is a great help in cases of this kind. Sometimes, too, a change of air and scene for the mother will do more good than medicinal tonics, although I cannot lay too great stress on the actual remedial value to be found in constant encouragement on the part of the physician. The patient relies on the verdict of her doctor, and to be assured that "her milk will certainly come freely" often results in bringing about that very condition, per the action of the sympathetic nervous system.

One factor in a deficient milk supply which is not usually given sufficient consideration is caused by permitting a patient to undergo too long and too tedious a labor, which can often be avoided by instrumental delivery; therefore every physician should be skilled in this art and be supplied with the necessary equipment. Again, too liberal use of an anæsthetic might have a tendency to delay the milk flow, therefore, your assistant who administers the anæsthetic must have a thorough knowledge of the exact amount needed. Then, too, post-partum hemorrhage requires prompt and skilful care and attention; lacerations should be repaired at once, as they serve to put a subsequent drain on the system, and every feature of the labor which makes a special tax on the patient's vitality should be carefully avoided if for no other reason than its influence on the milk supply.

There is another feature, too, which I cannot emphasize too strongly in reviewing the situation concerning normal healthy children—the employment of a thoroughly competent nurse, and one trained for obstetrical work. It is a deplorable fact that the majority

of nurses lack this special training, and while it is obviously true that the average physician cannot possibly give the necessary time and attention which every obstetrical case demands, it is equally true that the nurse in such cases should be almost a medical assistant as well. This is particularly so in cases where Nature requires assistance; and while the majority of physicians may leave too much to the nurse, it is equally true that the majority of nurses have no conception of the gravity of their responsibilities in an obstetrical case, and absolutely no knowledge of what is best to do for emergencies that constantly arise, and which must be met promptly and intelligently, often before the physician himself can be communicated with. A nurse should thoroughly understand everything connected with the care of the breasts, for delay in applying the proper remedies at the proper time may often result in losing the milk secretions altogether.

Just because a mother nursed her first baby normally is no reason why she will be able to do the same with a second one, and *vice versa,* so it is well to keep a careful record of every case which is handled.

I think many medical colleges fail to give sufficient training as to the care of the woman before and during pregnancy, and training schools for nurses are often lacking in the same way. Such training should cover a thorough understanding of the physiology and anatomy of the mammary glands as well as of the entire body, and every physician should be able to make a scientific examination of the mother's milk in order that he may detect wherein it is lacking and supply the lack by directing proper diet; he must also see to it that his directions are faithfully carried out.

Then, too, more attention should be given to the care of the breasts themselves before and after the birth of the child. Oni, in treating the question of sore nipples, said that one out of every two women was affected in this way. If, after careful examination, the nipples are found to be small, flat, and not to protrude sufficiently, gentle manipulation, pulling the nipples outward, should be practised and a lotion, not too astringent, should be applied. If this should fail to produce proper development of the nipples then a breast pump should be used, and I have found the Yale pump the best. It works on the same principle as a bicycle pump and succeeds in doing just what you want in the way of elongating the nipples. If you will notice the breasts of your patients carefully you will observe that near

the base of the nipples and upon the surface of the alveoli are numerous sebaceous glands which become much enlarged during lactation, and present the appearance of small tubercles beneath the skin. These glands seem to secrete a peculiar fatty substance which serves as a sort of protection to the integument of the nipple during the act of sucking, therefore when this is absent you have a condition of what might be termed " dry sucking "; the nipples often become macerated, fissures occur and bacteria gain entrance into the deeper tissues, causing mastitis and sometimes suppuration. Should this occur, a harmless oily substance (olive oil or coca butter) may be applied by being rubbed on before each nursing, and after the nursing an astringent antiseptic solution should be applied; if fissures should occur a solution composed of the following ingredients should be used:

℞. Pulveris alumenis .... ʒi
Glyc. acidi tannici .... ʒiv
Liquor antiseptici .... ℥iii
Liquor calcis .... q.s.Oi
Shake.
M. Sig.—Apply to nipples after each nursing.

After the last nursing of the day, when the breasts rest for several hours, at least, it is well to apply an ointment consisting of

℞. Balsam Peru .... ʒi
Ung. zinci oxidi.
Lanolin āā .... ʒiv
M. Sig.—As above.

Should mastitis occur and pus be formed, surgical treatment should be given without delay.

Both nurse and physician should have a thorough knowledge of breast massage and should know when to use it, as this is perhaps the one sure way of relieving what is known as " caking of the breasts," which is not only one of the most painful of ills connected with breast feeding, but which also leads to most serious complications.

From all of this we will see that to prevent the bottle-fed baby we must combat conditions which precede the life of the infant on earth and which should really begin with the first dawn of that life from the moment of generation. Indeed, the bottle-fed baby is but the stepping stone to the badly fed baby, and we all know that this means the sick, the weak, the emaciated and the unnatural baby.

But were I to speak with "the tongue of men and angels" I could not plead too earnestly with you, my fellow physicians, to unite with me and with every other physician with whom you come in contact, in teaching the mother the vital need of natural nourishment for her offspring, and then in doing everything in your professional power to make her physically fit to give this nourishment, and enable her to keep its supply unstinted during the months it is needed for the very life of her child.

Much can be accomplished toward this end by diplomatic means; much by instruction, encouragement, and assistance, and so great is my personal faith in our American women that I believe the majority of them, our efforts once made, will co-operate with us in recognizing that it means health, strength, power and even life itself to the helpless spark of immortality which owes its heritage of earth as well as its hopes of heaven to the mother who gave it birth.

Neurology

ATYPICAL MULTIPLE SCLEROSIS; ATYPICAL EPILEPSY; CEREBRAL SYPHILIS WITH MOTOR APHASIA AND RIGHT-SIDED HEMIPLEGIA; CEREBRAL SYPHILIS WITH LEFT-SIDED HEMIPLEGIA *

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ATYPICAL MULTIPLE SCLEROSIS

I WANT to show you to-day four instructive cases. The first, you will remember, has been once before the class, and I show her to you again because the case is one that is exceedingly interesting. The disease is multiple sclerosis of a very atypical character. You all recollect that the cardinal symptoms of multiple sclerosis are the eye manifestations, the paralytic symptoms, the tremor, and the speech peculiarities; and you should know that we account for all these manifestations on the pathophysiological basis of a lesion, a scattered or multiple lesion, pearl-like, and in spots in the brain, medulla, spinal cord, cranial nerves, and, in very exceptional cases, the roots of the spinal nerves.

The patient, Mrs. A., American, thirty years of age, is a housekeeper by occupation, and has been married six years. Her husband, she tells us, is healthy, although she has not heard from him for the last two years, he being in Australia. She is the mother of two healthy, normal children, aged five and two years, respectively, who are now living with her. A miscarriage occurred in the interval between these children. Menstruation began at twelve, and has always been regular, painless, and of normal flow.

As to the family history, her grandparents were healthy, as far as she knows. Her father is living at sixty-one, but is rather freely

* A clinical lecture.

addicted to the use of alcohol and tobacco. Her mother died at fifty-five of Bright's disease and complications, and without any pelvic trouble. One brother is living and healthy; four brothers, two of whom were twins, died in infancy from causes unknown. The other near relatives, aunts, uncles, and first cousins, all enjoy good health, as far as is known.

Parenthetically, let me say, in view of the question of hereditary influence in the etiology of insular sclerosis, that some years ago I presented to the Chicago Neurological Society a typical case of the disease in a man, the younger and weaker of twins, whose grandparents on the father's side were first cousins; whose father, uncle, and aunt were born deaf-mutes; and whose mother fell an easy victim to deaf-mutism after a severe attack of scarlet fever.

The patient herself has had no bad habits as to the use of alcohol, drugs, and so forth. All specific disease is denied, and there are no evidences now of specific trouble. She recalls having had only measles and chicken-pox in infancy, but no other infections. She has never had any convulsions. Three years ago there was a purulent discharge from the left ear which lasted about a week, but she has had no trouble since. She comes to us now on account of a peculiar sidewise or lateral twitching of the eyes. This began about two years ago, following the birth of her last child. At that time she also experienced very severe headaches which lasted several months, and which under treatment disappeared for about a year. They then came on again and lasted for six weeks; after an interval they appeared again for a couple of months, then quieted down, and so on alternately. For pretty nearly a year, or at least for the last eight or nine months, she tells us, she has not had what she would term a headache. She has some distress about the head at times, when nervous and excited, but not a distinct, sharp, definite headache or anything like she had two years ago and during the preceding year. These headaches were occipital and nuchal, rarely frontal, the pain running down the spine into the shoulders. From the description the patient gives they quite closely resemble attacks of atypical migraine. She used to have headaches on and off from her twenty-second year on, but never as pronounced as they were a year ago and during the preceding year.

I want to call your particular attention to the twitching of the

eyes. We call it, technically, nystagmus. You have all seen nystagmus, and in this case you will notice that when the eyes are put upon extreme lateral tension it is very distinct. When I put my finger thus to one side and ask the patient to look at it without moving her head, you will observe a regular oscillation laterally; there is also a slight oscillation vertically, but I do not detect any oscillation in the circular movements. Nystagmus is not noticeable when the fingers are held directly in front of the eyes; and when you fix the eyes in the middle position there is no jerking movement. This is a very interesting minor point in differentiating pseudonystagmus of an emotional character or, from lack of attention, from organic nystagmus, which has nothing to do with the mind and is wholly beyond the control of the patient. And yet the nystagmus here is observed slightly when you use the ophthalmoscope in looking into the patient's eyes. You can see the blood-vessels tremble a little, thus revealing the symptom even in the front position. Nystagmus is present, therefore, and is the dominant symptom in this case. There have been several distinct attacks of diplopia or double vision. When the nystagmus is bad the diplopia is pronounced. Sudden looking around to the right or left produces marked attacks of vertigo, a significant symptom, objective in character. Things outside of her seem to move instead of herself moving. We call this objective vertigo. Note that the vertigo appears mostly upon sudden movement, such as getting up and sitting down, and when turning suddenly. It diminishes, but does not cease, when she is lying in the horizontal position. As soon as her eyes are opened she experiences these vertiginous sensations; when she closes them they do not occur. After she has been asleep and wakes suddenly it is not so noticeable. It is significant that when lying on the left side the vertigo increases much more than when she lies on the right side. These are about all the symptoms that the patient can give us herself.

I am going to ask her to stand up and walk and I want you to notice the gait. Carefully observe that it is not a typical ataxic gait, as in locomotor ataxia; and yet it is an incoördinated gait. It is much more like a titubating, reeling, or drunken gait; what we technically speak of as a cerebellar gait, which I have often illustrated to you. Instead of there being an irregularity and difficulty in bringing the foot down upon the desired line or spot, one reels

exactly like a man who has had too much liquor; it is well-named a drunken gait. On account of this incoördination and difficulty she has trouble when she sits down, occasionally misses the chair and falls to the floor; and when she falls she says she falls to the left. Carefully note that when she walks there is a tendency to turn to the left. Remember, in this connection, that when she lies on the left side the vertigo is worse, and that there is a history of a purulent discharge from the left ear three years ago. There has never been abnormal temperature. The same incoördination appears in the hands occasionally. She tells me that when she sets things on the table, at times she fails to reach the table, and they fall to the floor; this has amused her, and she attributes all this to her eye trouble. She herself says, and likewise her friends, that there has never been any change in her speech. I will ask her to repeat the sentence, "Peter Piper picked a peck of pickled peppers." She says it very well. I will ask her to repeat the words, "It is very crowded on State Street to-day." There is nothing like the typical scanning speech; it is a little catchy, and I think there is a little, but very slight, hesitancy in the speech.

In regard to paralysis, she does not exhibit any typical paralytic symptoms; her limbs move freely and the hand grip is good, and tight; the dynamometer registers normal and the same in both hands. Lately she complains of stiffness, and a feeling of numbness in the legs; when rising from a chair she has to wait a minute to get started. By watching carefully you will notice a slight spasticity when she starts to walk. When she tries to get up from a chair there is a tendency to a rolling movement. She tires very easily, and whenever she tries to do anything, to write or to walk, she soon becomes excited and wants to stop. She protrudes the tongue straight. There is no ptosis, nor have there ever been any distinct apoplectiform or epileptiform seizures during all this time; nor any hemiplegic indications.

In regard to the tremor, there is a slight difficulty in writing, but she accounts for it by saying that it seems as though her hand tires and she would rather stop. I have had her write several times for me, and her friends confirm the fact that there is no objective change in the writing. I cannot detect any change indicating tremor. We will ask her to put her fingers in the usual way, bringing them near together, and holding them a quarter of an inch apart; you will

notice that there is apparently no intentional tremor whatever. She touches her right ear with the left hand and her left ear with the right hand perfectly, without any intentional tremor. I have tested it in the usual way by having her pour water from one test-tube into another, and she does not spill a drop; nor does she spill anything when drinking from a cup or glass. There is no tremor of the tongue, intentional or otherwise.

In regard to the reflexes, we find that the pupils are similar and respond well to light and accommodation; the knee-jerks, however, are exaggerated; the reflexes are slightly exaggerated in the upper extremity; the abdominal reflex is absent; the jaw reflex does not seem to be affected. There is no ankle clonus, nor can a typical Babinski, Oppenheim, Gordon, or Chaddock phenomenon be elicited.

In regard to the sensations of the body, I can find no objective cutaneous signs of change. Temperature, pain, and touch sensations seem to be normal over the whole body. There is no disturbance of the sphincters; and no evidence of asynergy, as we call it, weakness so that the patient does not move with the promptness and coördination that she should. On account of the slight spasticity she has difficulty in moving her limbs, but there is no typical asynergy or weakness characteristic of cerebellar disease. She perspires excessively, especially under the arms, and flushes easily with excitement. She has gone down in weight from 139 to 121½ pounds; sleeps well, and is not troubled by dreams; mentality is normal, except that she easily gets excited, and is inclined to be unduly hilarious at times. She enjoys life fully, she says, and I am glad to say that she takes her condition less seriously than most people would. Thus there is a tendency to well-being, good feeling, and unusual optimism.

I have had all the laboratory tests made in this case, and find both the urinalysis and the blood examination to be negative. The von Pirquet, as well as the Wassermann test, the latter made twice by Dr. A. W. Stillians, was negative; and a skiagraph of the cerebellar region, taken by Dr. Max Reichmann, revealed nothing abnormal.

The ophthalmological examination, made by Dr. C. A. Leenheer, to whom we are indebted for the case, gave the following results: Vision, R.E. $^{15}/_{100} - 2$ cy axis $180 = {}^{15}/_{15} - 2$; vision, L.E. $^{15}/_{40} - 1.00$ cy axis $180 = {}^{15}/_{15} - 3$. Yaeger, 0.5 with glasses.

Lids and conjunctiva normal; cornea, clear; iris, reacts to light and accommodation; both same size; lens, clear. Fundus, blood-vessels normal size. Papillæ distinct; no choking disks; tension normal; muscles, normal in all directions; no muscle imbalance. Fields, interlacing, overlapping of colors (Figs. 1 and 2). Nystagmus, horizontal type; increased when muscles are put on tension laterally, either to right or left.

The following otological report has also been made by Dr. Leenheer: Three years ago had running ear; left; for about one week. Never has had any trouble since.

RIGHT.—Whisper, 20 feet; watch, 2½ feet; C^2 40 air conduction; 22 bone conduction; Galton, high and low tones heard.

FIG. 1.

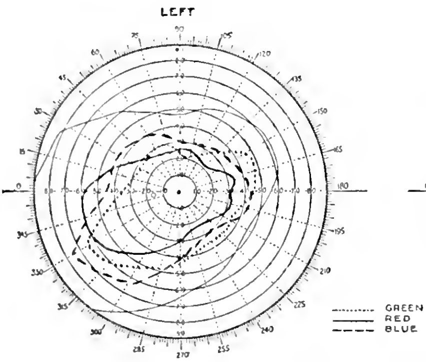
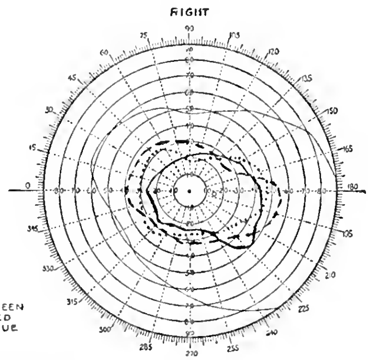


FIG. 2.



Color fields of patient suffering from atypical multiple sclerosis.

LEFT.—Whisper, 15 feet; watch, 2½ feet; C^2 42 air conduction; 23 bone conduction; Galton, high and low tones heard. Drums, both slightly retracted, otherwise normal.

As to the differential diagnosis between cerebellar neoplasm and multiple sclerosis, called for in this case, I have jotted down a few points to save time. In favor of a cerebellar neoplasm we have the typical cerebellar gait; the tendency to turn to the left; slightly unilateral character of the manifestations; nystagmus; intense and constant vertigo, which is worse when she lies on the left side. The appearance of the visual field-charts is most interesting. The interlacing of the fields, according to Cushing, may indicate intracranial pressure and not merely functional trouble. The increase of the

knee-jerks, the tendency to tire easily, the obscure history of headaches off and on, for about six or seven years, and the suppurative otitis media of three years ago would naturally lead one to think of cerebellar trouble, possibly abscess; but the absence of neuroretinitis is against such a diagnosis. Dr. Leenheer and a number of ophthalmologists have examined the case and can discover no evidence whatever of the least choking of the disk. Furthermore, the absence of vomiting and of nausea, of true asynergy, of the distinctive intracranial neoplastic headache, and the negative skiagraph must be given due weight. There are no evidences of lues, or of tuberculosis to suspect new growths along these lines. The manifestations of the trouble following an infection of the puerperium and its remittent course are to be noted as in favor of multiple sclerosis. At times the patient has been well, or better, and then again worse; and in the last two years the disease has receded rather than increased. The patient thinks she is, on the whole, a little better than she was a year and a half ago.

Note also for disseminated sclerosis the presence of nystagmus, the typical wabbling gait, the exaggeration of the knee-jerks, the increasing stiffness in the lower limbs, and the delay in getting started. I have tested the abdominal reflex very carefully, and I cannot get it after a number of trials. The jerking movements at night, especially in the left leg, she tells us, become cramp-like. Occasionally there is hesitancy in the speech, though not a typical scanning speech. At times there is a slight difficulty in swallowing, reminding one of globus hystericus, which, however, it is not. There is distinct diplopia at times; and you must not overlook the marked and peculiar vertigo, the optimism, and the hilarious mental characteristics. To be frank, I must state to you that against the diagnosis of multiple sclerosis are to be noted: the absence of intentional tremor, of all paralytic manifestations, scanning speech, sphincter trouble, jerky movements about the head and tongue. The presence of equal pupils, both of them normal in size and in their reflex responses.

The optic disks reveal no temporal pallor such as we expect to find in cases of multiple sclerosis. There have been no apoplectiform or epileptiform seizures, which are also characteristic of multiple sclerosis; and, finally, there are no sensory phenomena of an objective

character, though the patient complains of numbness. In spite of all this, I am satisfied that the diagnosis of the case should be atypical multiple sclerosis, and several neurologists who have seen the case agree with me. Now, multiple sclerosis is, according to some authorities, an exceedingly rare disease. That, I believe, is true. Typical Charcot multiple sclerosis is exceedingly uncommon. Spiller, of Philadelphia, considers it one of the rarest diseases we meet; while other neurologists, however, believe that it is one of the commonest, and that we are overlooking a great many cases by not recognizing them as such. In this second statement is included not alone typical Charcot multiple sclerosis, but almost all forms of scattered myelo-encephalitis, or encephalomyelitis. But these, in my opinion, are not typical cases of multiple sclerosis, although their symptomatology resulting from a scattered, vascular, inflammatory lesion, due to an infection, might not differ much from that of typical multiple sclerosis.

ATYPICAL EPILEPSY

I want to present to you another interesting case which I have seen but once. First let me pass around a chart from a book loaned to me by my office associate, Dr. George F. Suker, and ask you to look at the lower right-hand picture of the eye-ground. It is typical of the appearance of the back of this man's eyes.

C. P., a patient of Dr. A. S. Hershfield; aged 23; of Hebrew nationality; with no occupation at present on account of his trouble; married three years; of an even temperament; and with a good grammar-school education. Of his grandparents he knows nothing. His father is living at forty-two, but is not a healthy man. The cause of the father's sickness is unknown to the patient, but he says he coughs and spits a good deal; in a general way it sounds like a case of tuberculosis. The mother is living at forty-two, the victim of very severe headaches; beyond that, she is healthy, as far as the patient knows. He has three sisters and four brothers, whose history is negative. The mother's sister has intense headaches, and was once confined in an asylum for mental trouble. The father's brother had what was supposed to be tuberculosis, dying of this disease at the age of forty-eight. The patient himself has two healthy children, one two years of age, the other ten months. He has no bad habits

as to alcohol, diet, or tobacco. All possibility of specific infection is denied. In infancy he had measles and chicken-pox, and a year ago was said to have had diphtheria. He has had whooping-cough; no rheumatism, no typhoid, no pneumonia. He has no cough now, nor anything to indicate lung trouble; arteries are normal; alimentary tract performs its functions, and the genito-urinary tract seems to be healthy, as far as the objective findings go. All the laboratory findings are normal, the blood count, Wassermann test, etc., demonstrating nothing pathological.

The patient comes to us because for a month or six weeks he has had most intense headaches. The present trouble began about a year and a half ago, consisting of generalized headache, nausea, and, for a time, fever which confined him to his bed. He got well of this, left the hospital, and went home. During the spells of headache he vomits and always complains of intense melancholy; at times he is entirely free from headache. The "spells" sometimes would be relieved by a drink of water; sometimes there was no headache with these "spells," and there were no chills nor unconsciousness. You note these so-called "spells" were very indefinite; yet the patient clearly recognizes that something happened at a certain time which he calls a "spell" and which was not normal. The headache he complains of for the last month or six weeks has at times been very intense and exceedingly sharp. He feels it chiefly above the eyes. His voice is normal, his speech natural; his handwriting the same as usual.

Mentally he experiences periods of intense melancholy, slight dizziness, poor memory, and lack of the power of attention. He gets angry easily, but is careful not to lose control of himself. In other words, he is very irritable, but outwardly tries not to show it. He regrets being very timid, hesitating over everything; that is, he lacks initiative force. He wants to accomplish much, but analyzes himself incessantly and hesitates before undertaking anything. Lumbar puncture was done at one of the leading hospitals in the city and only normal cerebrospinal fluid was found. All other laboratory findings were negative. There are no motor symptoms. The only sensory symptoms he refers to are numbness in the hands when he wakes up at night. There are no "pins and needles" feeling; no objective sensory disturbances that I can detect. He gets

flushed easily when embarrassed, and the only trophic or vasomotor-trophic symptom present is perspiring very easily (hyperidrosis).

Now comes a most interesting feature about the case. This man was in a hospital with the general history that I have given you. His eyes were examined there by a very competent ophthalmologist, and the trouble pronounced to be intracranial pressure and typical "choked disk." He was advised to have a craniotomy done upon him, and preparations were all made to go ahead with the operation, when his family physician said, "Hold on; we will wait. I am not satisfied." This threw the patient into a state of opposition. He did not want to go on with the operation, and he finally came to us. I have had the eyes repeatedly examined by Dr. Suker, Dr. Loring, and Dr. Findlay, whose opinions we all regard most highly, and they tell me positively that this man has not a "choked disk." I have examined the fundi myself, and the appearance is easily such as to suggest "choked disk" in a hurried examination, though I would not have called it such. In the upper inner quadrants, and especially on the left side of the whole upper half of the disk, the border is not distinct, but has the radiated appearance you see in the picture. The blood-vessels are very clear and evenly defined. The illustration is as much like this man's fundus as if you were looking into his own eye. If you place the ophthalmoscope so as to look a little sidewise, you will see, almost under the blood-vessels, a shadow movement. In other words, there is a physiological cupping of the disk, a deepening of the depression. On the other hand, the fringe-like border is indicative of some congenital condition, possibly not wholly unlike opaque fibres. All of which gives the disk the appearance of being "choked" and of beginning to swell.

What is this patient's trouble? If you will recall the history of the case, there were migrainous headaches, and a record of tuberculosis in the family. Is it possible that the patient is a victim of intracranial tuberculosis or tubercular meningitis? The possibility of it is to be thought of, but the direct evidences for such a diagnosis are not very satisfactory. None of the tests for tuberculosis were confirmatory, and all the symptoms of tuberculosis or of meningitis are far from being positive. So latent are these conditions at times, and for long periods of time, that they are among the most difficult to diagnose.

For the present, it seems to me safer to look upon the case as one of epilepsy, symptomatic epilepsy, or probably idiopathic degenerative epilepsy. I have brought the case before you on account of the difficulty in the diagnosis. The appearances of the fundi are very well described thus by my *confrère,* Dr. George F. Suker: The edge of the disk is slightly hazy above in the left eye and somewhat in the upper nasal quadrant in the right eye. The vessels are a little enlarged in both eyes, somewhat more so in the left than in the right eye. The vessels nowhere sink out of sight, as in "choked disk," nor are there any other evidences in the eye of intracranial pressure. The vision in both eyes is $^{20}/_{20}$, or normal.[1]

TWO CASES OF INTRACRANIAL SYPHILIS PRESENTING DIFFERENT CLINICAL PICTURES

I am going to show you these cases because they go together very well. One of them you have seen before. Their etiology is similar, but their symptomatology is different. One has a complete left-sided hemiplegia, with all the typical, associated signs, such as spasticity, contractures in the arm and leg, peculiar gait, increased reflexes, ankle clonus, Babinski, Chaddock, Gordon, and Oppenheim phenomena. The other case is not so marked in this respect, for there is only a little weakness in the right hand, chiefly in the thumb. The reflexes are slightly exaggerated and there is a Babinski sign that is not always easily demonstrated. There are no sensory disturbances and very slight paralytic manifestations. There is, however, a marked speech difficulty, and one might refer to the case as the speech form of hemiplegia.

I will discuss these patients separately in a moment. I want you to see them together now.

The trouble with the young woman is on the left side. She is a right-handed individual normally; therefore, there is no speech disturbance. She talks very plainly and readily. The man is a right-handed individual, but now has a slight right-sided paresis, with very marked speech disturbance of the typical motor-aphasia

[1] Here the class were shown Fig. 3, Plate 1, in the volume entitled "The Fundus Oculi," by W. Adams Frost, and their attention called to the illustration, in the lower right-hand picture, of a physiological cupping of the optic disk, oval disk, and striation of the upper and lower borders of the disk.

type. In both cases the diagnosis is thrombosis, lues being frankly admitted by both.

The man is 36 years of age; a baker by occupation; of Hungarian nationality; and frankly admits having acquired specific disease and undergone treatment for it. Till June, 1911, he seemed perfectly well, when upon a hot day, at about five o'clock, he fell and was brought home unconscious. He recovered consciousness very quickly and discovered a weakness in the right hand and right leg; the latter recovered rapidly. While there are some hemiplegic symptoms of a somatic character, as I have demonstrated to you, they are nothing like as marked as in the other patient. He, however, noticed that he had distinct difficulty in speaking; and, as I have proved to you before, it is of the pure aphasic type, not a mere dysarthria of the cerebral type. He can use his lips and in his own language (German) can utter words perfectly. He can repeat from dictation; and can follow what is read to him or what he reads to himself; but the moment he tries to formulate his ideas and to utter them, there seems to be a hiatus or rupture between the idea and the words, and he utters words he does not mean to. Words and sentences come out which he recognizes are wrong and do not convey the intended thought. In other words, he has the aphasic form of apraxia; that form which Marie would associate with a psychic trouble, but which we as yet do not recognize as purely mental, but rather as physiological, involving the functions of Broca's centre, the third left frontal convolution. There is a variety of asymbolism or apraxia wherein there is a break between the formation of ideas and the appropriate symbolization of those ideas in speech. That is what we mean by aphasia. The older authorities used to say that there were images of words in the mind before the lips formulated them. For instance, if one wanted to say "a cup of water," one had to form first in the mind exactly the words that were to symbolize the idea so that the person listening would bring exactly what was being thought of. The older authorities declared that the mind created a picture to itself as to how to set the lips, the vocal cords, and the breathing apparatus to produce the appropriate explosive sounds which we employ when we ask for a cup of water. Nowadays, however, we do not believe that the mind produces any image of words in this sense any more than the stomach creates an image of digestion prior to the act. When food is placed

in the stomach it begins at once to act on it. Speech is a physiological function, developed by evolution and training, wherein the moment an idea arises in the mind the words or symbols are formed at the lips. Aphasia means the failure of ideas in the form of symbolization; any form of defective symbolism in the expression of an idea being an aphasia. If it is in the gesticular movements of the shoulders or hands, which again is but another sort of language, it is denominated a gesticulation aphasia or pantomimic disturbance. One can have aphasia in any way whereby he uses his muscles to give expression to the ideas that are in his mind, provided the trouble is not mere paralysis or incoördination. Aphasia is a very different thing, therefore, from dysarthria. There is a psychic element in it. Most of the cases of hemiplegia and apoplectiform trouble with speech disturbance which you will see in practice will represent typical cerebral dysarthria or true paralysis of lips. Yet such cases are usually put down in the physicians' records as cases of aphasia. Dysarthria is purely a want of ability to use the lips properly and to make the sounds of language. The differentiation of aphasia from dysarthria is not difficult if the essential nature of both is carefully remembered.

In the patient before us there is no amnesic aphasia; no visual aphasia, or alexia. He hears and reads language, but the moment he tries to emit his own ideas, to give expression to them in symbols, he fails. He does not seem able to think of the proper word, and utters words that he really does not mean to use. This, therefore, is a case of pure motor aphasia involving Broca's centre, probably subcortically. In all likelihood there is a minute obstruction in one of the terminal vessels that supply Broca's centre. The lesion is probably a minute thrombus due to an arteriosclerotic condition of the blood-vessels from the specific infection.

In the young woman the lesion may involve the third convolution on the right side, analogous to Broca's centre on the left, but, this not being used in speech, no disturbance occurs. The pathological involvement is doubtless extensive enough, but clinically only the left-sided hemiplegia appears.

Symposium on Anæsthesia*

GENERAL REMARKS ON ANÆSTHETICS

BY EDWARD MARTIN, M.D.
Professor of Surgery in the University of Pennsylvania, Philadelphia

PERHAPS I can do no better in opening a general discussion upon the subject of anæsthesia than to briefly outline some of the principles upon which at the hospital of the University of Pennsylvania we base our choice of anæsthetics, for in that institution practically all methods, both local and general, are used at times. We, however, have a very distinct choice for ether by the open method where muscular relaxation is required, preceded by nitrous oxide, and for nitrous oxide and oxygen for such surgical procedures as require but a few minutes and can be successfully performed, even though there be either continued or recurrent muscular resistance. We have all learned to believe the most important factor of safety is dependent upon the anæsthetist. With us it is either a nurse specially trained for the service or one of the younger men widely experienced. As to the nurse, we have learned to place absolute confidence in her, and of 2600 major operations, mainly under nitrous oxide and ether, but two have died upon the table, nor in either case could death be properly attributed to the anæsthesia. Postoperative pneumonia has developed once during the exceedingly cold weather after an operation which lasted one and a half hours. As to the choice of the anæsthetic, local infiltration is practically used only for superficial lesions or for sections done *in extremis*. There is a growing tendency to employ oxygen and nitrous oxide for major operations, even those which require upwards of half an hour for their performance, and

* With the exception of the papers by Dr. Edred M. Corner and Mr. Lawrence Irwell, the articles comprising this symposium are based by the various writers on remarks made at the meeting of the Philadelphia County Medical Society for April 10, 1912.

with increasing experience upon the part of the anæsthetist and betterment of the apparatus used, muscular rigidity and venous congestion are both becoming less marked. The after effects, either immediate or remote, in these prolonged administrations seem to be practically none, though it is true that a certain percentage vomit, a distinctly smaller one than is recorded for ether. Also, we are learning to recognize the cardinal importance of bringing the patient to the anæsthetist in a condition of, if not absolute cheerfulness, at least of philosophical tranquillity, readily obtained in the great majority of instances by a preliminary dose of morphine and atropine. All recognize the fact that terror, whether outwardly controlled, or uncontrolled, makes anæsthetization difficult. A larger dose of the drug is required, the preliminary stages are attended by excitement and jactitations and undirected muscular movements which in themselves are a source of very real peril to patients with cardio-vascular lesions. Deaths under anæsthesia are probably more frequently due to the burden thrown upon an incompetent heart by the mental and physical struggles of the terrorized patient during the early stages of the ether than to the acapnœa so carefully studied by Henderson. Nor is it needful that the patient who has dilated his heart by such struggles or by post-anæsthetic vomiting should die at once. Providing the patient begin his anæsthesia with a tranquil mind, there seems no prohibitive reason, even based on an advanced arteriosclerosis, against the use of nitrous oxide and oxygen. The increased blood-pressure resulting therefrom is probably no greater than that to which he is subject in the ordinary affairs and movements of life many tmes each day. Indeed, the safety of the procedure is abundantly attested by statistics. Probably not so clearly proved by the records of surgical clinics if they were all tabulated, since there is undoubtedly a distinct mortality from nitrous oxide incident doubtless more to the inexperience of the anæsthetizer than to the drug itself. A particular service rendered by this anæsthetic agent is due to the fact that its repeated administration at short intervals is attended by no cumulative evils. The results of chloroform thus given are so well known that it is now universally avoided. In our clinical work ether has to an extent seemed to exhibit with each repetition at comparatively brief intervals a distinctly prolonged period of convalescence from its effects. In serial operations required by certain

plastic procedures or by a gradual mobilization of joints with limitation of motion, and in many other circumstances repeated anæsthesia is needful, nor can any agent yet proposed take rank with nitrous oxide when such conditions present themselves.

Recurring to the heart condition it is our custom, particularly with athletes, to subject them to some physical strain at the time of first examination, and if this is followed by untoward rapidity and by irregularity in action we use morphine and atropine as a preliminary for the purpose of avoiding entirely subconscious or unconscious struggle which with such patients might prove dangerous or even lethal.

For short operations ether may be used with probably as little danger as that incident to nitrous oxide, provided it be carried only to the preliminary stage, in which anæsthesia is complete though consciousness is not entirely abolished. It is an old method at one time popular, but now fallen mainly into disuse, no doubt incident to fashion, which seems to dominate medical and surgical practice almost as absolutely, and at times as unreasonably, as it does the architecture of a woman's dress. The patient is directed to count slowly, ether being given in the open manner. When this counting becomes irregular the needful procedure is completed as rapidly as possible, the ether being taken away. This condition of anæsthesia precedes the stage of struggle and is not prolonged by giving more ether.

Perhaps the most difficult case to anæsthetize safely, with complete relaxation, is the red-faced, bull-necked, turgid-veined semi-drunkard, who alternates, even in skilful hands, between the condition of black asphyxia and violent jactitation. A preliminary dose of morphine and atropine usually simplifies these cases. It is possible that direct intratracheal insufflation may be the true solution of the difficulty.

ETHER ANÆSTHESIA

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The 16th of October, 1846, is a notable day in the annals of surgery, for on that day Morton persuaded Warren to let him try ether, or "Letheon," in a case of tumor of the neck, in the Massachusetts General Hospital, and the effect was so satisfactory that Warren said to his class, "Gentlemen, this is no humbug"; and to-night, sixty-six years later, we can pertinently repeat his words—"Ether is no humbug." Like the Constitution of the United States, it has been subjected to many attacks, but it still stands. It has been submitted to the "referendum," but, in the minds of the majority, it has not been "recalled." From the standpoint of reliability, safety, and general applicability, it is still *"facile princeps."* In 407,553 administrations the total number of deaths was 25, or one in 16,302. Statistically, nitrous oxide is the safest anæsthetic, but these statistics have been based on periods of short anæsthesia, and it is evident, from a study of its use for prolonged anæsthesia, that the mortality is greater. Enthusiastic advocates of nitrous oxide and oxygen always cite the statistics of Teter, of Cleveland, of 17,716 administrations, varying from two minutes to four hours, without a death, forgetting the experience of Bennett, Allen, and others. I believe that if the statistical study were based upon the duration of the anæsthesia, ether would still stand as the safest anæsthetic for major surgery. It is the one which produces the unconsciousness which is quite as great a blessing as the relief from pain, and, as Keen has observed, "The ideal anæsthetic will not be one which will abolish pain without abolishing consciousness. To have the patient aware of surgical emergencies, which test even a veteran operator's skill and resources to the utmost, would frequently invite death by the terror which it might occasion. The ideal anæsthetic abolishes pain by the abolishment of consciousness, but without danger to life." To reduce this danger to a minimum, care must be exercised in the selection of the patient, the anæsthetic, and the anæsthetizer.

Contra-indications to the use of ether are, usually, contra-indications to the performance of elective surgery. A patient with advanced degeneration of the blood-vessels, acute or chronic parenchymatous nephritis, acute or chronic bronchitis, emphysema or pulmonary tuberculosis, is not a good subject for surgery under any anæsthetic; but it is surprising how, with proper preparation and proper administration, the ether can be used with safety even in cases of marked cardiac disease or in the presence of disease of the kidneys. It is poor economy to use a cheap grade of ether. The best drug on the market should be employed. In one hospital I have noticed a marked increase in the bronchial irritation and subsequent nausea following the substitution of a cheaper grade of ether.

Time will not permit of more than a cursory mentioning of the elementary principles of preparation. The examination of the heart, lungs, kidneys, and the blood is imperative; the stomach should be empty and at least three hours have elapsed since the ingestion of food. If the operation is on the stomach itself, lavage may be practised, using boracic acid solution, normal saline, or pure water. All foreign bodies should be removed from the mouth. The clothing about the chest and head should be well loosened, and I, personally, believe that a preliminary injection of morphine, 1/6 grain, and atropine, 1/150 grain, is advantageous. This diminishes the reflex excitability of the air passages, decreases the secretion of mucus, and often lessens mental perturbation and nervous shock. I do not agree with Bevan, who believes that this medication "favors the retention of aspirated blood or vomitus" in the trachea. On the contrary, I think, it usually has a very beneficial effect. Attention should be paid to the psychic atmosphere of the etherizing room, which should be a quiet one, and, if possible, different from that in which the operation is to take place. Unnecessary persons, conversation, and noise should be eliminated, or, in other words, as Hare has expressed it, "Every effort should be made to surround the patient with the conditions conducive to ordinary sleep."

Much has been written recently of the non-graduate or trained nurse as an anæsthetist. The legal status of such an individual is difficult to define. Under our present laws the operator employing such an anæsthetist would be legally responsible, but, as suggested by Neely, in a recent paper before the American Hospital Association,

"It is far better to change legislation in order to make legal a *status præsens* than to permit the continuance of this medical practice by nurses, with a realization that it is conniving at illegality." No doubt the specially-trained nurse of many years' experience is a safer and more efficient anæsthetist than the tyro in medicine, yet her legal status is questionable. The very fact that so many recently-graduated hospital residents administer ether and don't kill the patient is *prima facie* evidence of its safety as an anæsthetic; for in nearly every large hospital in this great city the etherization of the average ward case is in the hands of the green resident, and yet the fatalities are surprisingly few. Many a surgeon has become gray-haired and almost strabismic trying to keep one eye on the anæsthetist and the other on the field of operation. This evil will be remedied when the remuneration of the anæsthetist in a hospital will be adequate to the skill and efficiency demanded. The ideal anæsthetist practises eternal vigilance. He is provided with mouth-gag and tongue-gag and tongue-forceps, for use only when necessary; he is supplied with a hypodermic syringe that is in working order, solutions and stimulants are readily available, and it is well for him to have an electric battery and a receiver of oxygen near at hand. He should know how to practise artificial respiration, and should have a definite knowledge of the anatomy of the air passages, be able to recognize the difference between asphyxia and anæsthesia. He should have a calm, assuring manner which will inspire the anxious patient, and the equally anxious surgeon, with confidence in his ability to cope with the unexpected. His sole object should be to keep the patient completely anæsthetized with the smallest possible amount of ether. Many devices and inhalers have been invented for the safe and economic administration of ether, some so complicated and expensive as to place them beyond the reach of the average practitioner, others simple in construction and easily obtained, but the man behind the gun, the personal equation of the anæsthetist, is, after all, the matter of paramount importance. A skilled practitioner with a grooved cork in a four-ounce bottle of ether and a few pieces of gauze will obtain just as good results as the neophyte with an Ormsby, Clover, or a Roth-Dräger apparatus. The character of the pulse and respiration should be watched faithfully, and the pupillary reaction be constantly observed. The bad habit of fingering the conjunctiva is to be

avoided, as the reflex can be elicited without touching the conjunctiva. The head should be placed in a position which will admit of free breathing through the mouth as well as through the nose, and the operator should be kept informed of the condition of the patient. An impatient surgeon may so interfere with the work of the anæsthetizer as to jeopardize the life of the patient. Care should also be taken to keep the body dry and warm; failure to observe this precaution often causes postoperative sequels that may be blamed upon the ether. Any evidence of flagging circulation or of failing respiration should be met by prompt stimulation, and an accurate record should be kept of all drugs administered. The after-effects of ether vary with the individual case. Vomiting is one of the most constant and annoying, but not more so than with other anæsthetics. The best remedies for persistent vomiting are inhalations of oxygen, or of vinegar, and gastric lavage. The respiratory disorders are not apt to occur if proper precautions are observed, and renal disturbance may be combated by diuretics, diaphoretics, enteroclysis, or hypodermoclysis.

Ether has often been made the scapegoat for the sins of omission of diagnostic acuity, or those of commission in slow and imperfect surgery. In arguing the cause of ether it is well to admit that no form of anæsthesia yet discovered is absolutely free from danger, but in the hands of the average man of average skill and cleanliness, with an average ability to recognize danger signals and to meet emergencies, in the private house, as well as in the hospital, in 90 per cent. of the cases in which anæsthesia is required ether sits enthroned, and our knowledge of it compared with some of the newer methods of anæsthesia leads us to conclude that it is wiser "to bear the ills we have than to fly to those we know not of."

CHLOROFORM ANÆSTHESIA

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Chloroform was first used as an anæsthetic about the same time as ether, or in the year 1847. The use of "chloride-ether" had been suggested to Sir J. Y. Simpson, of Edinburgh, who had for some time been endeavoring to find a less irritating and more convenient anæsthetic; and he soon satisfied himself that the vapor of chloroform, the most active ingredient of "chloric-ether," was capable of producing anæsthesia. He also noted that chloroform less frequently induced struggling and intoxication, so it is not surprising that its use rose rapidly in general favor, and to a large extent supplemented ether in general surgery.

Chloroform, as a general anæsthetic, is a drug to be administered with a great deal of respect; it is powerful and rapid in action, and, unlike ether, the danger signs are more frequently overlooked until too late. Taking everything into consideration, we may say that it is best administered by means of a Skinner's mask and a slow drop from a drop-bottle. In using this method, one should present a very dilute vapor to the patient, the older method of giving a concentrated dose being attended with a certain amount of risk. At the same time we must not lose sight of the fact that a too sparing use of chloroform is also open to objection. A few drops, with the mask well away from the face, should be first administered in order not to alarm the patient by any suffocative sensations. The mask should then gradually be brought nearer and nearer to the face. Any holding of the breath or coughing should be met with a partial withdrawal of the mask; the inhalation, however, should not be wholly discontinued, as an endeavor must be made to give a well-diluted vapor continuously. The administrator should steer between the two extremes—not too rapid nor too slow. Children and weak patients require less, while more will be needed in the case of the alcoholic, etc. Beginning with the first drop and constantly during the whole time, the

utmost care should be exercised, the slightest change in the patient's condition should be noted as with all other anaesthetics, only the smallest amount which will produce surgical anæsthesia with safety to the patient should be administered. Surely chloroform, above all others, calls for the open and drop method. As chloroform undergoes decomposition readily when exposed, there is no doubt that many of the deleterious effects are produced by the inhalation of these substances. So the best method is to use only one- or two-ounce bottles and open a fresh one for each administration.

The phenomena of chloroform anæsthesia are in their main features so similar to those which have been already described as characterizing the use of ether that it will probably be better to compare the two than specially to describe the phases through which the patient passes while inhaling chloroform.

First Stage.—The vapor of chloroform is more pleasant to inhale than that of ether, and, when given with a copious supply of air, the sense of suffocation, which is not infrequently complained of with ether, is reduced to a minimum. There is also less swallowing, coughing, holding of the breath, etc., than with ether.

Second Stage.—Shouting, gesticulation, screaming, etc., are more often met with under chloroform, but do not last as long. Muscular and alcoholic subjects, as well as hysterical and excitable patients, may give a little trouble during the period of rigidity by attempting to hold the breath and assume a sitting posture. Prolonged tonic-spasm should make the administrator cautious, and, though he need not, as a rule, discontinue the administration, he should not push the drug rashly.

Third Stage.—The signs and symptoms of deep "surgical anæsthesia" under chloroform are very similar to those of ether. Certain remarkable differences, however, obtain. The respiratory movements are not, as a rule, so deep, so quick, nor so noticeable as those met with under ether, and while this condition, because of this quietness, may be favorable to the performance of many operations, it is not as satisfactory as ether respiration; and, as the respiratory act is the never-failing guide in case of doubt, too much stress cannot be laid on this point. The circulation is comparatively sluggish when taken with the bounding and somewhat accelerated pulse of ether anæsthetization. As to the pupil, all observers agree that it is usually

contracted, and under chloroform one is more likely to see the "pin-point pupil." In the muscular system there is a more complete relaxation. As a rule the features are less dusky, probably due to more air being allowed, and to less mucus and saliva being present.

This anæsthetic, like all others, has its advantages and disadvantages. In a general way chloroform is more pleasant to the patient. The suffocating symptoms experienced at the beginning are not as distressing and, as there is certainly less flow of saliva and of mucus, there is also less struggling and choking. It is quicker in its effects, and so saves time, especially in large clinics and on the battle-field. Also, in a certain class of patients, chloroform only will give the desired relaxation. In young children and babies it is indicated because it is less alarming and less irritating to the upper air passages, while, at the other extreme of life, one often finds "chronic senile bronchitis" or "emphysema"—then again, chloroform is usually the drug of choice. In the presence of certain diseases of the kidney, this agent should be employed because the small amount necessary produces less irritation. It also is indicated in advanced affections of the lungs, especially when the cardiac condition is perfectly normal.

The writer wishes to emphasize the advantages of chloroform for a certain class of patients, namely: pregnant women, especially in the latter months. It has been his privilege to have considerable experience in this phase of the subject. The safety in the administration of chloroform as an anæsthetic, in obstetrical work, is well known to all. As a rule, very little of the agent is necessary; the patient is soon under its influence, and there are seldom any unpleasant after-effects. I have been unable to find a single record of any fatal results of chloroform under such conditions.

As to the disadvantages of chloroform, there is at the present time no anæsthetic in common use which entails so great a risk of life to the patient. As has been pointed out, it is a powerful drug, quick and sly in its action, and it probably has caused more fatalities than any other agent used for surgical anæsthesia. No doubt a certain proportion of the deaths recorded have been due to faulty administration.

Dr. H. C. Wood claims that about four deaths from chloroform occur to one death from ether. With such facts known, the anæs-

thetist must hesitate and seriously consider each case in which the agent might be indicated. In its after-effects are probably the disadvantages more pronounced, for when nausea and vomiting occur they are, as a rule, more troublesome and distressing than with ether.

Of recent times we are learning, both from laboratory and post-mortem examinations, more about the tissue changes seen in prolonged or frequent inhalations of chloroform. There is no doubt but that the dangers of immediate death are well recognized and are carefully guarded against. It must be realized that even days and weeks after administration degenerative changes occur, principally in the liver, the heart muscle, and the kidney substance.

In the summary of the use of chloroform as a general anæsthetic, the writer feels that it should be employed only in a limited number of cases, after careful consideration of the general condition of the patient, the operation to be performed, length of time, and probability of shock, etc. In the obstetrical cases it may be used with a certain degree of safety.

As death is very likely to occur at a very early period in the administration, its effect must be constantly watched, always remembering to give a generous supply of air or of oxygen, and using only the slow-drop method; and, as in ether, on any failure of respiration, which is followed by cardiac failure, the administration should be at once stopped. The dangers of chloroform may, to a certain extent, be lessened if these points are carefully observed and the administration is not intrusted to the hands of the inexperienced anæsthetist.

NITROUS OXIDE ANÆSTHESIA

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The weight of evidence indicates that the anæsthetic effect of nitrous oxide is due to its inherent action on the cerebral centres. Crile, however, states "that it produces anæsthesia by prevention of the use of oxygen by the brain cells—anoxæmia of the brain cells." It is practically inert for other organs of the body, the narcosis ordinarily produced being partly due to asphyxiation. Nitrous oxide (N_2O) has no definite influence on the heart or arteries, but during its administration rise of blood-pressure and increased pulse-rate are usually noted. Wood's experiments show that the final fall of blood-pressure is due to paralysis of the vasomotor mechanism, probably of asphyxial origin. It kills by respiratory paralysis. Hamburger and Ewing conclude that it produces no surgically significant changes in the blood. In human beings the conjunctival reflex often persists after deep anæsthesia has been produced. It has no cumulative action and can be repeated without danger.

The safety and adaptability of nitrous oxide for minor operations of short duration are thoroughly established, and its superiority to all other anæsthetics makes it a necessity in every well-equipped hospital. As a preliminary to ether it has been thoroughly tested. We have used it at the University Hospital routinely for a number of years, and our experience convinces us that the gas-ether sequence has the following definite advantages over ether alone:

1. The distress of the first stage of ether is avoided.

2. It reduces the nausea and vomiting to a percentage no greater than that claimed for nitrous oxide and oxygen by those who employ it as a standard anæsthetic.

3. It reduces to a minimum postoperative bronchitis and pneumonia.

4. It saves time.

5. The amount of ether required is materially decreased, the

after-effects are consequently diminished and the patient's blood and kidneys are in better condition for early convalescence and ultimate recovery.

We omit nitrous oxide in case of infants and patients with advanced arterial degeneration.

ADMINISTRATION

When the Cryer apparatus, or the simple portable bag and cylinder is used the undiluted gas is given until the patient is anæsthetized. About a drachm of ether is placed upon gauze, which is quickly transferred to the patient's face without allowing a breath of air; ether is then continued by the drop method. If there is no leakage around the mask and the administration is skilfully performed, the stage of excitement and excessive flow of saliva should be eliminated. If jactitation or cyanosis appear before the patient has had sufficient nitrous oxide, a couple of breaths of oxygen are given and nitrous oxide is then continued. I believe that the gas-ether sequence is the best routine anæsthetic.

In general surgical practice we have found it desirable to use nitrous oxide and oxygen alone in about 15 per cent. of cases. For example: Patients who are to leave the hospital within a few hours; patients with pulmonary lesions, particularly tuberculosis, provided there is no myocardial degeneration; patients with kidney insufficiency; those in whom anæsthesia must be repeated one or more times within a few days; patients who have an exaggerated dread of ether; and, finally, desperate cases, such as those suffering from shock, peritonitis, or profound sepsis, to whom ether would be detrimental.

Nitrous oxide-oxygen anæsthesia is contra-indicated in case of advanced myocarditis and in patients in whom cerebral congestion is especially to be avoided. It should not be employed when an anæsthetist skilled in its use is not available, and when the patient takes it badly.

The question before the profession, as to how far this method of anæsthesia shall be extended, cannot be settled as yet, as the total experience with it in prolonged operations is relatively small. While nitrous oxide administered for a short time is undoubtedly the safest anæsthetic known, nitrous oxide-oxygen is by no means free from danger, when used for longer periods. Statistics are mislead-

ing, because the two classes of cases are not separated. Crile, who is its most enthusiastic advocate, ascribed one fatality to it in his first report. Gatch reports 2,500 cases, from Halstead's clinic, with three fatalities, for which the anæsthetic was more or less responsible. I believe that this anæsthetic was contra-indicated in two of them on account of the heart lesions present. Lydston reports one fatality from Chicago; Gwathmey, of New York, mentions two cases in the practice of a professional anæsthetist; Freeman Allen reports one death and mentions two others in Boston, and there has been at least one in Philadelphia.

Nitrous oxide-oxygen anæsthesia has undeniable advantages. It is not unpleasant to take, and a patient can often be persuaded to submit to operation under it when ether would be declined; it has no postoperative effect on any organ, and, consequently, at the completion of the operation the patient is in better condition for recovery.

The disadvantages are:

1. It is difficult to obtain muscular relaxation, particularly in abdominal work. In fact, it is necessary to give a little ether in about 60 per cent. of abdominal operations.

2. It requires skill and long training to use it properly.

3. There is more venous congestion in the field.

4. It is expensive.

The cost of the gases will average about six dollars an hour when purchased in cylinders. This can be reduced to half the amount, by manufacturing nitrous oxide in the hospital. The expense can be still further reduced by employing the principle of rebreathing, introduced by Gatch. Whether or not rebreathing should be endorsed involves a consideration of a number of points which have not yet been settled, such as the physiologic properties of expired air, the limits of safety of carbon dioxide in the blood and its relation to respiration. Rebreathing is endorsed by Henderson, but his theories of acapnia and shock have not been fully accepted. Two fundamental facts must be kept in view, namely, that nitrous oxide itself is practically harmless, and that the tendency to asphyxia is constantly present during its administration. Any untoward symptoms arising either in respiration or circulation are more likely to be due to insufficient oxygenation than to any other factor.

THE USE OF ETHYL CHLORIDE AS A GENERAL ANÆSTHETIC

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For major operations requiring deep, prolonged anæsthesia and complete muscular relaxation ether has long been considered the safest narcotic, and will probably continue to be so, when the anæsthetic is to be given by the occasional anæsthetist.

There are, however, very definite dangers and discomforts in ether anæsthesia which Bevan and Favill have shown to be in direct proportion to the amount and concentration of the anæsthetic. Crile believes the immediate discomfort caused by the irritation of the mucous membranes to be a real danger, for the resulting fear of asphyxiation, he thinks, plays a very important rôle in the causation of so-called postoperative shock. Cardiac failure and respiratory arrest everyone has seen: and we have learned to dread the post-anæsthetic nausea and vomiting, the bronchitis, œdema of the lungs, pneumonia, nephritis, and acidosis.

As profound ether narcosis is required in but a small proportion of surgical operations, and then only for a small portion of the whole period of anæsthesia, the substitution of other anæsthetics or the modification of ether anæsthesia would certainly seem desirable. During the last ten years we have been trying, at the Pennsylvania Hospital, to find the anæsthetic best adapted to the individual patient and to the proposed operation. Morphia, atropine, scopolamine, cocaine, stovaine, ethyl chloride, anæstol, chloroform, and ether have all been used, and your chairman has asked me to report our experience with ethyl chloride.

The inhalation of ethyl chloride will induce general anæsthesia without the respiratory irritation of coughing, gagging and vomiting

so often seen with the first and second stages of ether narcosis. With the patient lying supine, breathing quietly and naturally as though preparing for sleep, the ethyl chloride is slowly dropped upon several layers of gauze held about six inches from the face, and while the gauze is gradually lowered to the face the dose of ethyl chloride is increased until the patient loses consciousness, when the gauze is again folded (8 layers) and shaped about the nose and mouth in such a way as partially to exclude the air, and the ethyl chloride is then given rapidly in the form of a spray. The patient will have reached the stage of unconsciousness without the least suggestion of suffocation, coughing, or other irritating symptoms. A short time before the loss of consciousness there is anæsthesia to very severe pain, and this stage may be employed for minor operations: the opening of abscesses, setting of fractures, dressing of painful wounds, or other surgical procedures of five to ten minutes' duration, which do not require muscular relaxation, as the resection of a rib. When the ethyl chloride has been given rapidly or in large concentrated doses, or without sufficient air, there is frequently an arrest of respiration at the time when consciousness is lost, while tonic spasm of the masseter muscles, and even general muscular rigidity or convulsion, may occur. But if the patient is carefully watched and the anæsthetic removed at the first appearance of this "forgetting to breathe," or on the appearance of muscular spasm, the respirations will be resumed and the spasm relieved. I want to emphasize the fact that such symptoms indicate that the anæsthetic is not being properly given, for when the ethyl chloride is administered slowly, allowing from two to three minutes to the stage of unconsciousness, and the dosage is gradually increased with a free admixture of air, a more careful observation of progress of the anæsthesia is allowed and the respiratory arrest and muscular spasm do not occur. As narcosis deepens, the eyeballs begin to roll and the pupils partially dilate, indicating that the patient has reached the second stage, in which there is profound anæsthesia without muscular relaxation, and frequently with muscular rigidity and spasm. It would seem that this is as far as the average patient can be safely carried, the danger rapidly increasing after this stage. The eyeballs become fixed, the pupils dilate widely and are immovable, the corneal reflex disappears, and the face is flushed and covered with perspiration. This undoubtedly is the danger line beyond which the

respirations insidiously become shallower, with consequent deepening cyanosis, the eyeballs may diverge, while the muscles are rigid in tonic spasm or they become flaccid.

Reaction is very rapid after the withdrawal of the anæsthetic, usually within two to three minutes. Vomiting may occur before consciousness is regained, but rarely afterward. We have not seen the headaches and depression referred to by the English writers, and no pulmonary or nephritic complications have been observed following the use of ethyl chloride at the Pennsylvania Hospital.

The fatalities seem to result, primarily, from respiratory, and, secondarily, from cardiac failure, the heart continuing to beat for some minutes after the stopping of the respiration. Large and Brown, experimenting upon dogs, found that there was always a fall of blood-pressure, preceded, in a few cases, by a slight rise, and a number of clinical observations upon man have confirmed these findings. They suggest that the respiratory failure follows a paralysis of the respiratory centre as a result of the lowered blood-pressure.

Thus while we can quickly and pleasantly induce general anæsthesia with ethyl chloride, it is rarely possible to obtain the muscular relaxation of the third stage of ether, and then only by approaching, or going beyond, the danger point. Therefore, when general muscular relaxation is desired other anæsthetics should be combined with it, in order to avoid the unpleasant discomforts and dangers of the preliminary stages, and to obtain the relaxation of the third stage of ether or chloroform. Such anæsthesia is started by dropping ethyl chloride upon gauze, as before described, and adding the ether, drop by drop, upon the same piece of gauze, at the time when consciousness is lost; the dosage of the ether being rapidly increased, while that of the ethyl chloride is rapidly diminished, until ether alone is being given. If a sudden change is made from ethyl chloride to ether the patient will recover from the effects of the former before the intoxication of the latter appears. This anæsthetic would thus seem peculiarly adapted for minor surgical operations not requiring muscular relaxation, and not extending over a longer period than ten minutes. When used in combination with ether the immediate discomforts of the latter are certainly eliminated. From a personal experience I can speak of a very pleasant exhilaration with unconsciousness developing before I could count six, and this is almost the constant

description given by patients. While the danger of respiratory arrest may be greater than with ether, unless care is taken in administration,—the ethyl chloride being given slowly with a free admixture of air,—the remote discomforts and dangers are all decreased in proportion to the decrease in the total amount of ether used. It has been our experience that with the ethyl chloride-ether sequence 50 per cent. less ether is used during the first hour.

The comparative safety of anæsthetics is not easily determined. The skill of the anæsthetizer, the condition of the patient, the character of the operation, the quality of the anæsthetic, and the environment are variable and, often, uncertain quantities; while the newer the anæsthetic, the less valuable the statistics. At the present time I do not believe it possible to form an accurate estimate of the safety of ethyl chloride. Luke makes one estimate of 1 in 8,500, and a few months later 1 in 50,000. Herrenknecht repòrts 3,000 cases without a mishap, Webster 2,000 cases with no fatalities, and the writer has given it over 1,800 times with no deaths and since the first 100 cases no unpleasant complications. Hewitt places it between ether and chloroform. I have reviewed the records of the anæsthetics given at the Pennsylvania Hospital during the last ten years. Ether alone was used in major operations 8,286 times, four deaths occurring during its administration; ethyl chloride and ether were used together for 8,521 operations, with one death, and ethyl chloride was used alone in 1,129 cases, four deaths resulting.

In conclusion we would say that any anæsthetic which will produce dangerous narcosis in from 15 to 20 seconds is not safe in inexperienced hands, but we do believe that it has a special place in modern surgery. We feel that with ethyl chloride practically all of the discomforts of ether anæsthesia may be avoided, many of the dangers eliminated, and all of them modified; ethyl chloride should be used only by those experienced in its administration.

INTRATRACHEAL INSUFFLATION ANÆSTHESIA

BY GEORGE P. MÜLLER, M.D.

Associate in Surgery in the University of Pennsylvania; Surgeon to St. Agnes' Hospital, Philadelphia.

The subject assigned to me in this symposium, that of intratracheal insufflation anæsthesia, is by no means new in principle, but in its practical aspects dates only to 1909, when Meltzer (*Jour. Exper. Med.*, 1909, xi, No. 4, p. 622) showed that a continuous stream of air introduced at the bifurcation of the trachea was all-sufficient to maintain ventilation in the lungs. In order to bring the subject clearly before you, I will divide my remarks into three paragraphs.

(1) *Physiology.*—It is well known that the alveoli of the lung may be considered as a huge cavity containing, at the end of expiration, nearly 3,000 Cc. of air. At each normal inspiration, only 500 Cc. of air enter the respiratory tree, although it is possible by a forced inspiration to take in 1,600 Cc. additional air. About 140 Cc. occupy the "dead space" of the bronchial tree, leaving 360 Cc. to diffuse itself through the alveoli for the exchange of gases.

The system of ventilation employed under normal conditions is that of the action of the diaphragm and other respiratory muscles inducing changes in the size and shape of the thoracic cavity. The air is aspired by a continuous movement in one direction; at the end of inspiration, the ribs and diaphragm are brought back to the normal position by purely physical forces.

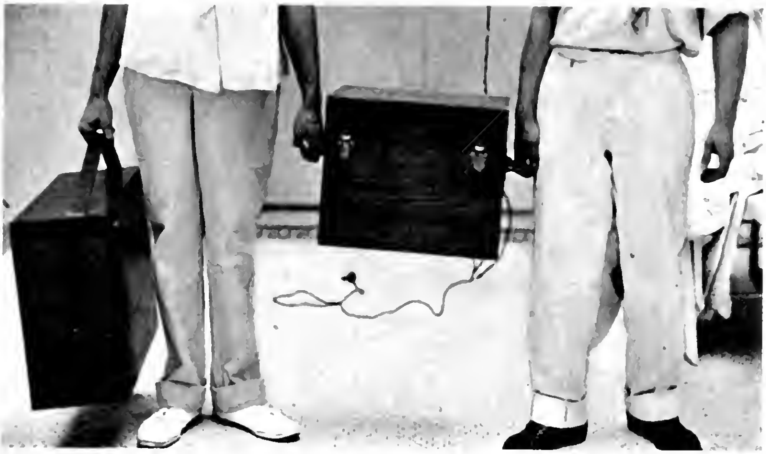
The exchange of the gases, oxygen and carbon dioxide, may be said to occur as a result of the difference in tension of each gas on either side of a membrane—the lung capillary and the alveolus, the peripheral capillary and the tissue juices. If, therefore, air can be made to enter the bronchioles in a continuous stream and diffuse itself into the alveoli, the function of respiration, to all intents and purposes, is carried on as well and as safely as by the natural action of the respiratory movements.

(2) *Differential Pressure Methods.*—Surgery of the thoracic

cavity has proceeded slowly, especially in comparison with surgery of the abdomen, owing to the difficulty of keeping up a normal respiratory movement with an open thoracic cavity. It is usually taught and believed that when the thorax is opened the pressure of the atmospheric air prevents the expansion of the lung and induces acute pneumothorax. But modern investigation has shown that this condition is simply one of mechanics, the opening in the chest wall being larger than the opening through the glottis, allowing the air to rush in and out during each movement of respiration, the lungs remaining collapsed as a result. It is true that the chest has been successfully opened for tumors, abscess, cavities, etc., but the results are not sufficiently encouraging to dwell upon, except in abscess of the lung, where the presence of adhesions, as well as other factors, makes the problem easy. Years ago Glück showed that if, after opening the chest, the lung was pulled into the wound as a plug, the operation could proceed without danger of pneumothorax. This procedure is obviously unsuitable to most cases. Many years ago attempts were made to perform artificial respiration by an apparatus, the Fels O'Dwyer being the most successful, and Doyen in 1898 devised a double-acting pump, which was also successful in an operation; in this country the apparatus of Matas is familiar to all.

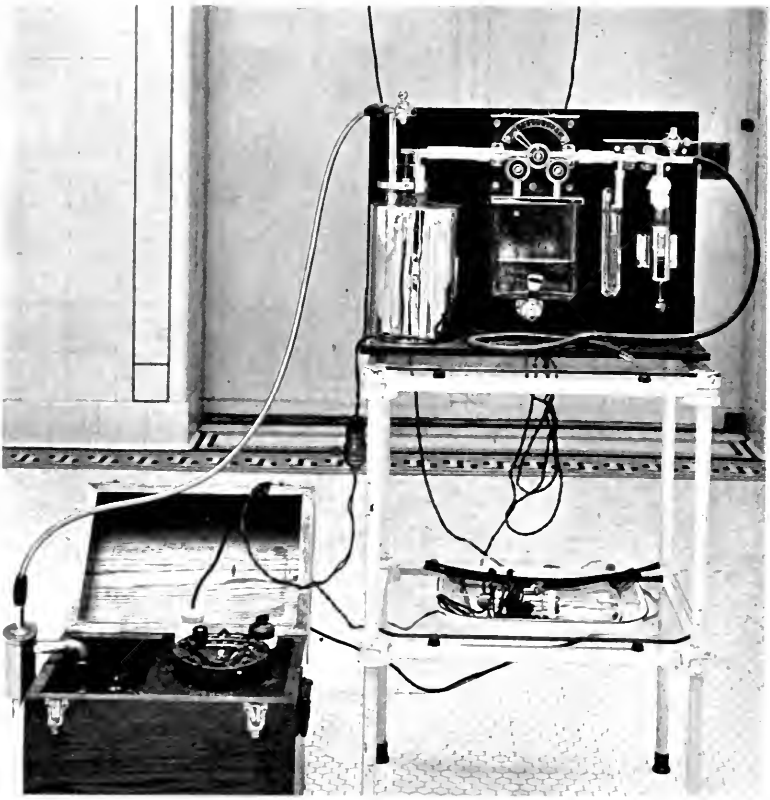
In 1904 Sauerbruch devised an apparatus which proved to be the starting point for the modern investigation of the subject. Briefly, he enclosed the patient, with the exception of the head, in an air-tight chamber, in which the atmospheric pressure can be reduced about 7 or 8 mm. This keeps the lungs distended. A number of these cabinets were built in Germany, and in this country Meyer, at considerable expense, built in the German Hospital, New York, a Sauerbruch cabinet in a suite of rooms devoted to surgery of the chest. About the same time Brauer devised a method directly opposite to that of Sauerbruch, although, so far as the effect upon the respiratory function is concerned, there is no difference between the two methods. In this method the patient's head is enclosed in a helmet or cabinet, the pressure in which is increased about 7 or 8 mm., in order to keep the lungs distended when the chest is open. Various other methods have been experimented with, but the above are the two most prominent methods of differential pressure.

FIG. 1.



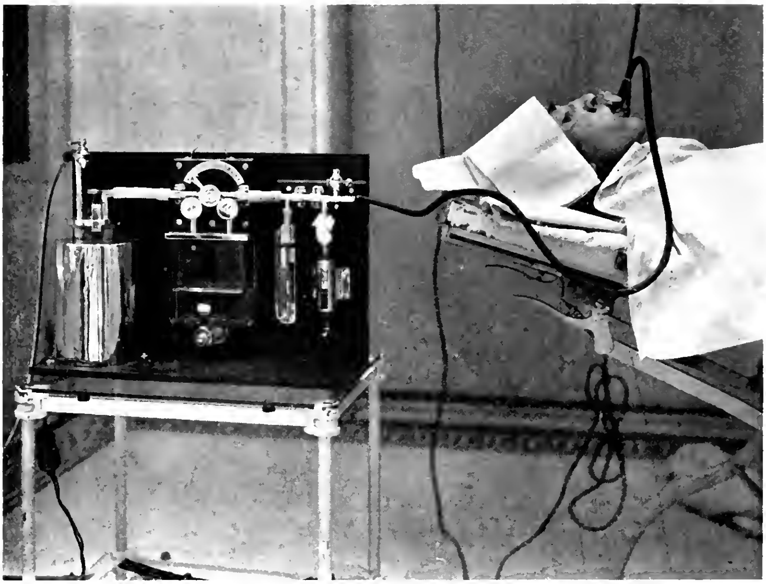
Apparatus for intratracheal insufflation anæsthesia packed in two boxes, illustrating portability.

FIG. 2.



Apparatus set up. Motor box on left, warming chamber, ether jar, manometer, and pressure regulator on table.

Fig. 3.



Apparatus with tube in position.

Fig. 4.

Illustrating accessibility of mouth cavity in operation on tongue, jaw, etc. The gag and tube are on extreme right side. Etherizer sits in front of apparatus entirely out of operator's way.

In 1909 Meltzer and Auer announced that the ventilation of the alveolar air can be satisfactorily accomplished in a similar manner as the one accomplished in internal respiration, if a tube of smaller diameter than the lumen of the trachea ejects a continuous stream of air at the bifurcation of the trachea under a pressure of 10 or 12 mm. of mercury. The apparatus used by them consists simply in a rubber catheter attached by a T-tube, one branch of which goes to a manometer and the other to a bottle containing ether, which in turn is connected by heavy rubber tubing with a foot-bellows. With this apparatus Meltzer has experimented on many dogs, in most of them the insufflation lasting for many hours and without any injurious effect. The paper of Melter and Auer made a profound impression upon surgeons, and started considerable controversy, which at first threatened to be quite bitter, and promoted the building of a number of apparatuses for use on the human being. The first really practical and safe apparatus for this purpose was devised by Elsberg, of New York, and published in February, 1911. Robinson, of Boston, who has done brilliant pioneer work in the new developments in thoracic surgery; Boothby, Flint, Ehrenfried, Fischer, and others have also devised apparatuses. Following the appearance of Elsberg's paper I had an apparatus made in Philadelphia, copied from his description, which has subsequently been so modified, and perhaps improved, as to differ considerably, although identical in principle. Details of the apparatus are shown in the appended illustrations. (Figs. 1 and 2.) As will be noticed, it contains a provision for a mercury safety-valve to prevent rupture of the lung tissue by overpressure, a device which we used long before the appearance of Boothby's paper, warning of the danger in its absence. Dr. Eisenbrey insisted that I add this to the apparatus.

We have used intratracheal insufflation in the University Hospital about thirty times, mostly in patients upon whom Dr. Frazier performed various cranial operations. It has also been used for laminectomy; carcinoma of the lip, tongue, and mouth; sarcoma of the tonsil; and in one case worked most successfully on a 22-months-old baby in which I excised the upper jaw for sarcoma. In no case has any complication arisen, except that a few times the patient complained of some pharyngeal irritation after operation, due, I believe, to the dragging of the introducer over the wall of the pharynx

in patients not completely relaxed. In every case the anæsthesia was satisfactory, continuous, and safe. In no case were we ever concerned with the condition of the patient in so far as the state of anæsthesia was concerned. Furthermore, in these cases of operation upon the oral cavity the feeling of safety engendered by the inability of the patient to aspire blood or mucus added greatly to the ease and technique of operation. The apparatus is expensive, but was well worth the cost, and should be regarded as essential to the proper equipment of a modern clinic.

(3) *Indications for Intratracheal Insufflation.*—The method was essentially introduced for use in thoracic surgery, and its value, at least from the experimental side, has proved to be above all criticism. The function of respiration is so surrounded with effective safeguards that even dislodgement of the lungs has no detrimental effect. But few operations have as yet been reported under insufflation anæsthesia, and further development may be expected in the surgery of malignant growths, actinomycosis, bronchiectasis, mediastinal tumor, stricture and tumor of the œsophagus, wounds of the heart and lungs, chronic interstitial pneumonitis, and certain selected cases of advanced tuberculosis. Operations on the head, the face, the mouth, and the neck are greatly facilitated, especially in regard to the aspiration of blood, mucus, or vomited material. In operations upon the cerebellum, or in laminectomy, or in section of the cervical roots where the patient lies prone on the table, the method is of distinct advantage.

It may confidently be asserted that with proper technique and an efficient apparatus—my own form will be seen by an examination of the illustrations—there is not the slightest danger to the patient from the presence of the tube in the trachea.

INTRASPINAL ANÆSTHESIA

BY WILLIAM A. STEEL, M.D.
PHILADELPHIA

During the past six years intraspinal, or, better, intradural, anæsthesia, has been used almost exclusively in the surgical service of the Samaritan Hospital of Philadelphia for operations below the nipple line. It has been given about 3,500 times. A limited number of upper chest, neck, head, and arm operations have been done under its influence; but the nicety of dosage required and the danger of respiratory paralysis have led to its abandonment as a safe anæsthetic in these regions. Our clinical experience with stovaine, novocaine, cocaine, tropococaine, alypin, and other similar synthetic products, has led us to regard stovaine as the most reliable of the group.

STOVAINE

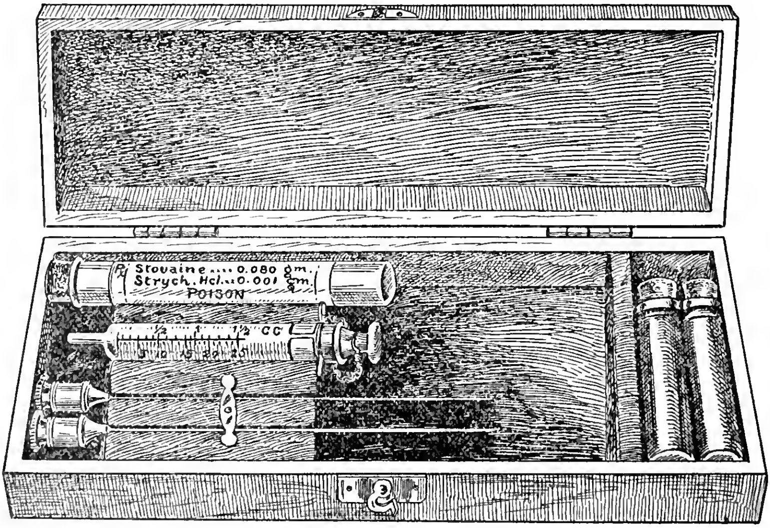
The tendency of stovaine to decompose rapidly by heat sterilization, or slowly if kept in solution in a warm place any longer than one month, has led to the practical use of one of two preparations. The one, in sealed ampoules containing 8 centigrammes of stovaine, 2 Cc. of watery solution of 10 per cent. alcohol, and ½ minim of lactic acid; or of compressed tablets of 8 centigrammes of stovaine, dissolved in a similar stock solution for each anæsthesia. The ampoules are kept in cold storage and renewed monthly. The alcohol aids the diffusion of the drug in the cerebrospinal fluid, and the lactic acid prevents precipitation, when the stovaine comes in contact with the cerebrospinal fluid. The average adult dose is 4½ centigrammes. The unpleasant effects of stovaine anæsthesia are from by-products liberated through heating, an overdose, or unreliable preparations. The solutions are best sterilized by fractional Tindalization. Everything pertaining to the operation may be placed in a box the size of a dissecting case (Fig. 1).

TECHNIQUE OF PRODUCING INTRADURAL ANÆSTHESIA

Nervous or excitable patients are given a preliminary hypodermic injection of morphine, gr. 1/6, and scopolamine, gr. 1/100, one-half

hour before operation; the eyes are bandaged, and the patient sits on the operating table with the arms folded over the abdomen. The back is antisepticized with 5 per cent. iodine crystals in acetone. The back is arched forward by the anæsthetic attendant. The spinal interspaces are localized by a sterile towel drawn across the iliac crests (Fig. 2). This passes through the spine of the fourth lumbar vertebra. Other useful anatomical landmarks are the vertebræ prominens; the depression of the eleventh dorsal interspace, and the fact that the tip of the twelfth rib lies opposite the second lumbar

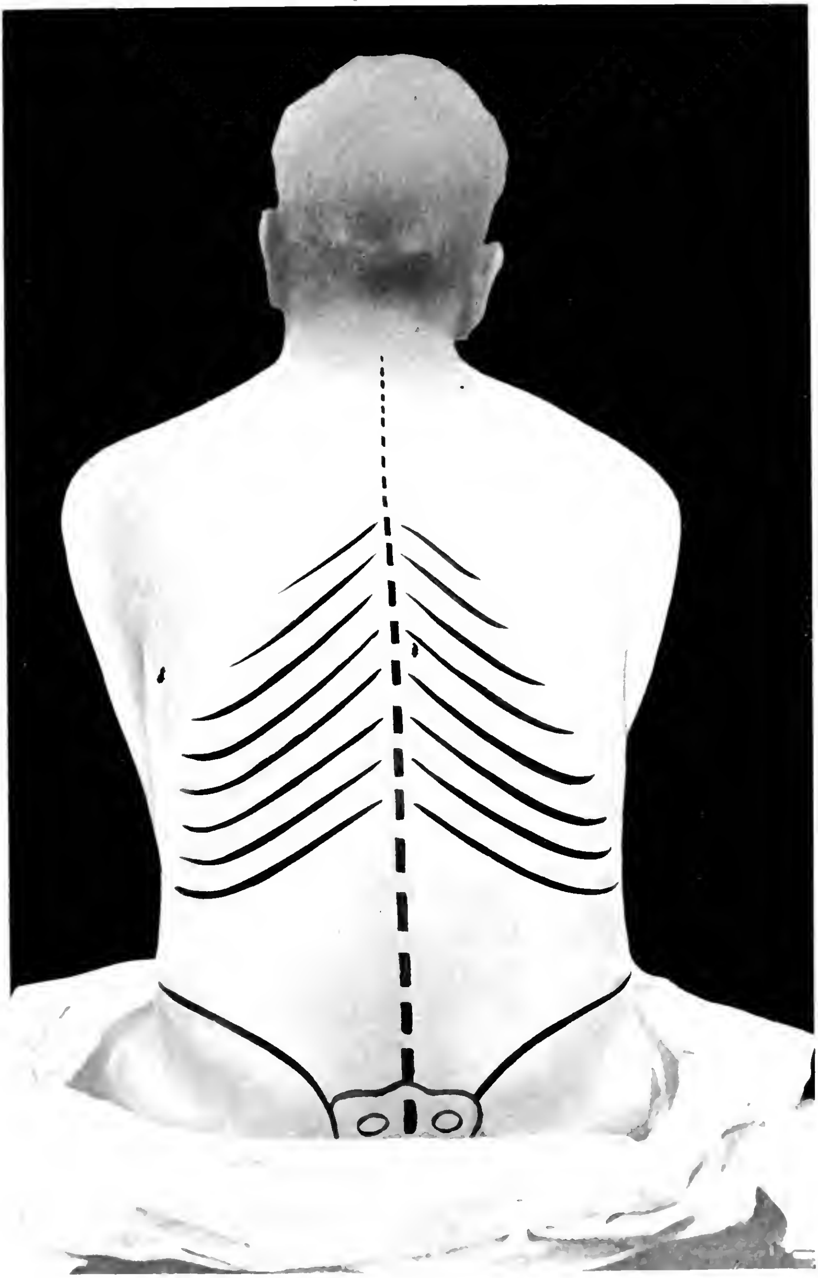
Fig. 1



Case containing outfit for intraspinal anæsthesia.

interspace. The injection is given in the second lumbar interspace for low abdominal, perineal and leg work (Fig. 3) in the twelfth dorsal, or the first lumbar interspace for high abdominal, or low chest operations. The point of puncture may be frozen by an ethyl chloride spray, but this is not necessary if a fine needle is used. The needle is of iridoplatinum, three and one-half inches long, and fitted with an obturator (Fig. 4). The syringe is a glass Luer, of 2 Cc. capacity. The needle is introduced at right angles to the skin, 1/8 inch to one side of the median line (Fig. 5); if bone is met with, the line of

Fig. 2.

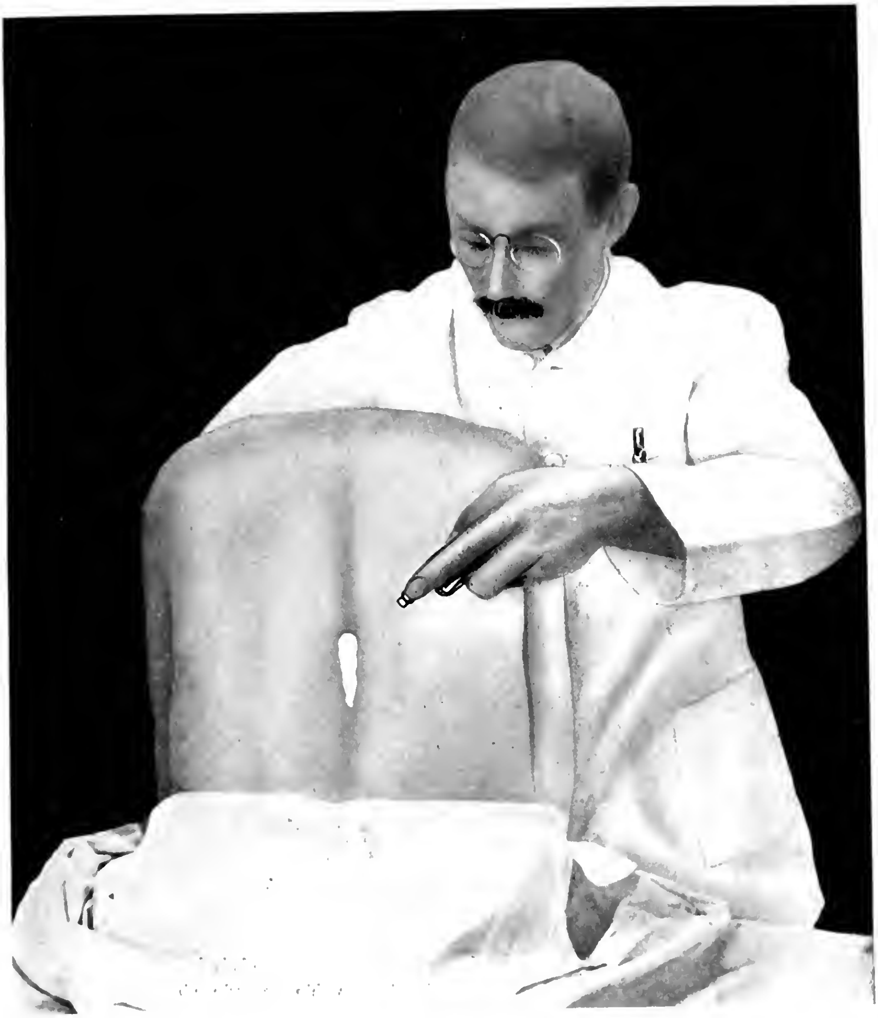


The relations of the lumbar and dorsal interspaces to the crests of the ilia and lower ribs.

Fig. 3.

Localization of the spinal interspaces. With the patient bent forward, a towel stretched between the iliac crests passes through the spine of the fourth lumbar vertebra. The first lumbar interspace is opposite the tip of the last rib.

FIG. 4.



The point of skin puncture is anæsthetized by freezing; this is not necessary if a fine needle is used.

Fig. 5.

The anæsthetic is freshly prepared for each case by dissolving within the syringe barrel the stovaine tablet in the alcohol-lactic acid solution.

introduction is raised or lowered. It is thrust through the skin, the edge of the erector spinæ muscle, ligamentum subflava, then punctures the tense dura frequently with an audible snap (Figs. 6 and 7). The escaping cerebrospinal fluid (Fig. 8) indicates its entrance into the subarachnoid space. The loaded syringe is attached to the needle, and if the fluid is withdrawn freely the injection is slowly given, the syringe is a second time sucked full and reinjected to insure the administration of the last few drops in the needle (Fig. 9). The patient is immediately laid prone or made to sit up for from one-half to one minute if a high effect is desired. The depth at which the dura is reached varies from one-half inch in infants to three inches in the very obese. In desperately ill patients the injection can be given with the patient lying on the side bent over a sand bag. If not narcotized the patient's mind should be diverted by conversation. Pain sense is lost first, then motor paralysis occurs, then there is loss of pressure and thermic sense, then the idea of the position of the legs, and with complete anæsthesia, the patient is unconscious of having any lower half to his body. The average duration of anæsthesia is forty-five minutes.

In desperately low patients a wisp of cotton is placed over the nose to indicate the respiratory action. Patients are not placed in the Fowler position until two hours after operation, as the said position may give a high anæsthesia with shock and respiratory failure.

ADVANTAGES

To Overcome the Disadvantages of Ether Narcosis.—(1) The choking and dread of taking ether and the vomiting and retching of ether convalescence are not present. (2) In operations on patients with bronchitis or local lung irritations, it lessens the likelihood of postoperative pneumonia and pulmonary œdema. (3) It lessens the postanæsthetic uræmia in nephritic cases. (4) It lowers the mortality in operations on septic cases where the added strain of ether elimination may overwhelm the patient. (5) The surgeon is relieved of the responsibility of directing an unskilled anæsthetist. (6) It gives the most complete muscular relaxation for abdominal operations. (7) It is well borne in the extremes of life; our list contains cases from two weeks old to ninety-two years. (8) It saves time in emergency operations, four minutes only being necessary

for anæsthesia, during which time the field of operation may be prepared.

Insures Physical Quietude to Septic or Perforating Intra-abdominal Lesions.—(1) Avoids the struggle of the stage of excitement of inhalation anæsthesia. (2) Avoids vomiting and strain of ether convalescence.

Facilitates the Work of the Surgeon.—(1) He is working away from the danger point, the patient is in better condition at the end than at the beginning of the operation. (2) He has personal control of his anæsthetic. (3) It causes most complete muscular relaxation. (4) It lessens the number of assistants. (5) There is less capillary hemorrhage, due to lowered blood-pressure. (6) With the patient awake there is a better morale about the operating table.

DISADVANTAGES

(1) The experience and skill required in its administration. (2) It is safely applicable only in operations below the nipple line. (3) If given in an overdose or too high it has a tendency to paralyze respiratory function, and hence must be used with caution in profound shock, in conditions causing depression of the spinal centres, and in intrathoracic lesions embarrassing the respiratory function, as pleural effusion, disseminated pulmonary tuberculosis, etc.

COMPLICATIONS

Death.—(1) No immediate deaths have occurred as a result of the anæsthetic in our 3,500 cases. One case of collapse occurred following the delivery of a huge fibroid tumor from the abdominal cavity. The patient never gained complete consciousness, but lived two days. (2) Nephritis, or reports of kidney lesions following stovaine anæsthesia have not been substantiated in our series of cases. (3) Spinal degeneration. No myelopathies have occurred in our series of cases. The ones reported from abroad were probably due to the septic poisoning causing death, and not to the anæsthetic. (4) Peripheral nerve paralysis. We have had one case of sciatic nerve paralysis, persisting for six months, where the injection was apparently given into the nerve roots. The case entirely recovered. Four cases of transient abducens palsy occurred during the early stages of our work, due to overdosage, all of which rapidly cleared

Fig. 6.

The needle is introduced at right angles to the plane of the back and slightly to one side of the mid-line.

Fig. 7.

As the dura is pierced, the cerebrospinal fluid escapes and may be collected in a test-tube for further study.

FIG. 8.

The syringe containing the proper dose of stovaine is attached to the needle and slowly injected.

up under eliminative treatment (hot packs and pilocarpine sweats). (5) Headaches. The one real distressing complication is the meningeal headache which occurs in about 10 per cent. of our cases. It lasts from a few hours to five days, clears up generally within twelve hours, and if persisting over that time yields readily to hot packs and pilocarpine sweats.

CONCLUSIONS

Intradural anæsthesia is a nerve-root, not an intraspinal anæsthesia, resulting in a form of massive regional anæsthesia, and having no direct effect upon the spinal cord proper. It is not a method for indiscriminate use in unpractised hands, as it requires more experience and skill in its administration than any of the regulation forms of inhalation anæsthesia. It is certainly less fool-proof than the administration of ether, chloroform, or nitrous oxide. For these reasons it will probably never become a universally used anæsthetic, but if its technique be once properly mastered, it is the method of choice in certain indicated cases, as in irritated lungs, myocarditis, damaged kidneys, senility, and septic conditions.

INFILTRATION ANÆSTHESIA

BY CHARLES F. NASSAU, M.D.

Assistant Professor of Surgery in the Jefferson Medical College; Surgeon to St. Joseph's Hospital, Philadelphia

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The two prime requisites for the production of local anæsthesia are: first, an exact knowledge of anatomical structures, and, second, skilful infiltration of the tissues by the anæsthetic. A discussion of the first of these requirements would be academic, and the second is acquired, like most technique, by constant practice only. Let us, then, rather consider the field of local anæsthesia.

In spite of the work of Schleich along the lines of local analgesia, notwithstanding the results of Cushing, of Baltimore, of Lennander, in Europe, and even in the face of the more recent but not less brilliant achievements of Mitchell in Washington, there is still a strong impression among the larger proportion of the profession that local anæsthesia is useful in slight operations only, such as the removal of warts and splinters. The experience gained in many major operations performed after the induction of local insensibility compels me to register here a protest against this unjustifiable impression.

Local anæsthesia in the case of old patients is a life-saver, and I am convinced that in operations upon the aged the large mortality in such patients may be traced directly to the use of a general anæsthetic. I do not wish to consider spinal anæsthesia, as I am not in favor of this mode of inducing freedom from pain, and use it on extraordinary occasions only.

In Dr. DaCosta's clinic at the Jefferson Hospital and in my own services elsewhere local anæsthesia is employed previous to operating upon many hernias, and in these cases there seems to be no reason whatever for general anæsthesia. Drainage of the gall-bladder may also be accomplished successfully by this mode of anæsthesia in cases not complicated by stones in the cystic duct. In strangulated hernias complicated by stercoraceous vomiting, and in all strangulated hernias in the aged, the administration of a general anæsthetic causes the balance of the scale to turn towards death. Whenever

vomiting is persistent, efforts should be made in such cases to operate under local anæsthesia.

Not only can the hernia be cured, but complications present, such as gangrenous or adherent omentum, gangrene of the bowel, and the like, may be very rapidly and successfully dealt with. After the delivery of a gangrenous loop of the intestine bowel, resection may be performed painlessly, providing that care is taken not to cause too much traction on the mesentery.

In amputations through the thigh and upper arm local anæsthesia is the best method for patients depressed and emaciated by long-standing suppuration; in stout people or those well-nourished there is, of course, no objection to ether. In amputations anæsthesia is obtained by carefully blocking the main nerve-trunks. In the thigh, for example, the sciatic and anterior crural nerves should be cut down upon through short incisions and blocked; after making a ring of infiltration in the line of the skin incision, the amputation can then be proceeded with. As a matter of fact, amputation by this method is followed by absolutely no shock, because the nerves have been blocked. We know, according to Dr. Crile, that the main nerve-trunks of the limb should be blocked, even where amputation is being done under a general anæsthetic. We are doing these operations for the radical cure of hernia in Dr. DaCosta's clinic at the Jefferson Hospital, and also in our own services at St. Joseph's and the Frankford Hospitals, with a degree of comfort to the patient that is astonishing. I recently operated upon a man in the wards of Jefferson Hospital who requested me as soon as I had finished operating on the right side to go ahead with the left, as he had not experienced sufficient discomfort to cause him to dread further procedure.

I find that the best solution to use in producing infiltration is made by utilizing a hypodermic tablet, already on the market, which contains three-fourths of a grain of cocaine and 1/400 of a grain of adrenalin. One tablet is dissolved in 50 Cc. of normal salt solution and one in 100 Cc. of salt solution, thus giving us two strengths of solution, known, respectively, as strong and weak. The stronger solution should be used in infiltrating the skin, blocking nerves, and for any particularly aberrant, painful spots encountered. The weaker solution is used for subcutaneous and general infiltration.

Since using these strengths of solution I have never seen any cocaine effects produced. A preliminary dose of one-fourth grain of morphine is always given hypodermically. This aids in calming the patient's mental fears of pain. The patient should be spoken to tranquillizingly and should be frankly asked to help in the operation. Obtain his absolute confidence, and state that if pain is caused the effort will not be persisted in. Explain that it is not always possible to be certain that some uninfiltrated tissue may not be handled accidentally. Perhaps it would be wise to compare the amount of pain experienced in having hernias operated on under local anæsthesia with the filling of a tooth; sometimes the latter hurts and sometimes it does not. If possible, have the patient about to be operated upon talk to another patient who has been operated upon. I find that the patient who has been operated upon invariably reassures the patient who is still considering such a step. It is better not to have the patient view the field of operation.

Hernias operated upon under infiltration suffer far less after-pain; sometimes, indeed, they complain only of a dull, heavy throbbing in the groin. They never vomit, and are able to drink any reasonable quantity of water at once, and if they are hungry they have light food on the day following the operation.

Now just a word of warning. While in the hands of one trained in methods of operating under local infiltration, do not be deluded by the idea that the infiltration accomplishes the operation. The utmost gentleness of touch, absolute certainty in clean anatomical dissection, light use of retractors, and, above all, absolutely no hurry are essential points to be taken into consideration.

Apart from the physical advantage of this method, such as absence of postoperative nausea or ether pneumonia, ability to drink water immediately, etc., there is the mental satisfaction of not giving up one's consciousness. It is extremely distasteful to most of us to relinquish all knowledge of surroundings, and seemingly hasten to a world of unknown terrors. Many a patient prefers keeping his hernia to taking ether. Local anæsthesia provides a remedy.

[Two patients were then exhibited before the society, and the statements were made by them that they had suffered no pain during the operation, nor was there any inconvenience following the effects of the local anæsthesia administered to them.]

EXHIBITION AND EXPLANATION OF APPARATUS FOR THE ADMINISTRATION OF CHLOROFORM, ETHER AND OXYGEN, WITH VISIBLE AND AUDIBLE DROPPING (APPARATUS OF DR. ROTH-DRÄGER)

BY P. BROOKE BLAND, M.D.
PHILADELPHIA

The general trend of research work dealing with chloroform and other anæsthetics has been in the direction of insisting on the necessity of the use of apparatus for the administration of gases which enable the anæsthetist to control the concentration of the vapor which the patient inspires. Several men in England and several in France have devised methods of giving more or less exact percentages of anæsthesia, but the apparatus under discussion is, in my judgment, the most satisfactory.

In travelling through Germany, in 1907, I saw used for the first time the Roth-Dräger apparatus. It was then employed only in a few hospitals. In a visit to the same country, and continental Europe in general, in 1910, this apparatus was universally employed, and it is in use now in several of the London hospitals and in a few institutions in this country. It is practically used exclusively in all of the university hospitals of Germany. In all, over 500 are now employed in that country. (Fig. 1.) The Gatch apparatus and the Ohio monovalve (Fig. 3) are also used in this country for similar purposes to those for which the Roth-Dräger outfit is employed. Fig. 4 shows the Ehrenfried intratracheal form of apparatus.

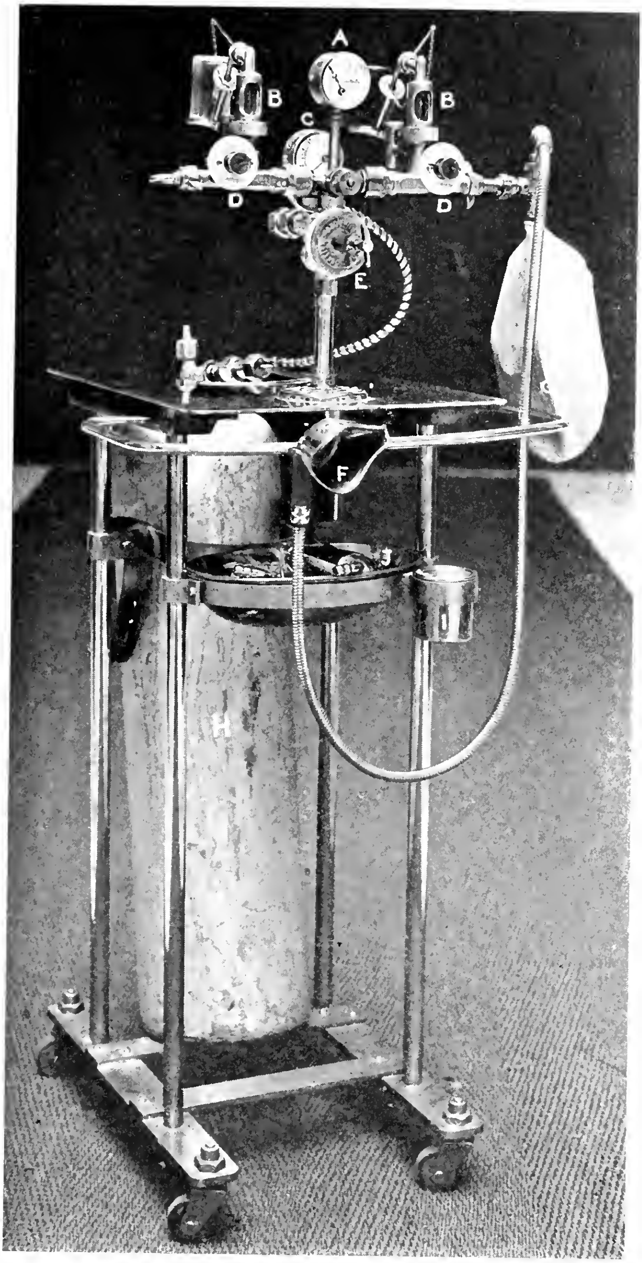
In this apparatus we have a mixture of atmospheric air, oxygen and a known percentage of anæsthetic vapor, and the patient clearly breathes to and fro into the facepiece without any special inspiratory effort. This apparatus is in no wise complicated, and may be used with perfect security by anyone familiar with the administration of anæsthetics. It is absolutely accurate in administration. It produces an easy and sufficient narcosis by gradually increasing the dose, or doses, of the anæsthetic agent, or agents, employed, and it enables the administrator to maintain full control of the amount of anæsthetic required at different stages of an operation. In the use of this instru-

ment, if one desires chloroform, he turns only one indicator; if he wishes to employ ether with chloroform, he can easily do so, and he can further regulate the amount of each as he deems the necessities of each patient require. We have found in our service that the inductive period, or period of relaxation, averages about fourteen minutes for adults. In the hands of the continental anæsthetist, the inductive period averages from six to eight minutes for adults.

It may be that we have not had sufficient experience with the instrument to bring the inductive period to that point. We have used it now in 125 cases. One thing is certain: that the use of this apparatus is seldom marked by excitement or struggling, and respiration seems free and unembarrassed. The narcosis is wholly satisfactory, and has always been sufficiently profound to perform any operation in the abdominal cavity. The use of oxygen, while it increases the cost of anæsthesia—a cost which could be lessened when large quantities of oxygen are under contract—certainly is of great value in the more serious operations now practised. The facepieces are rigid and are of three sizes. They are less adaptable for the edentulous, but fit very well when the face has not fallen in, and, above all, they can be, and always are, sterilized.

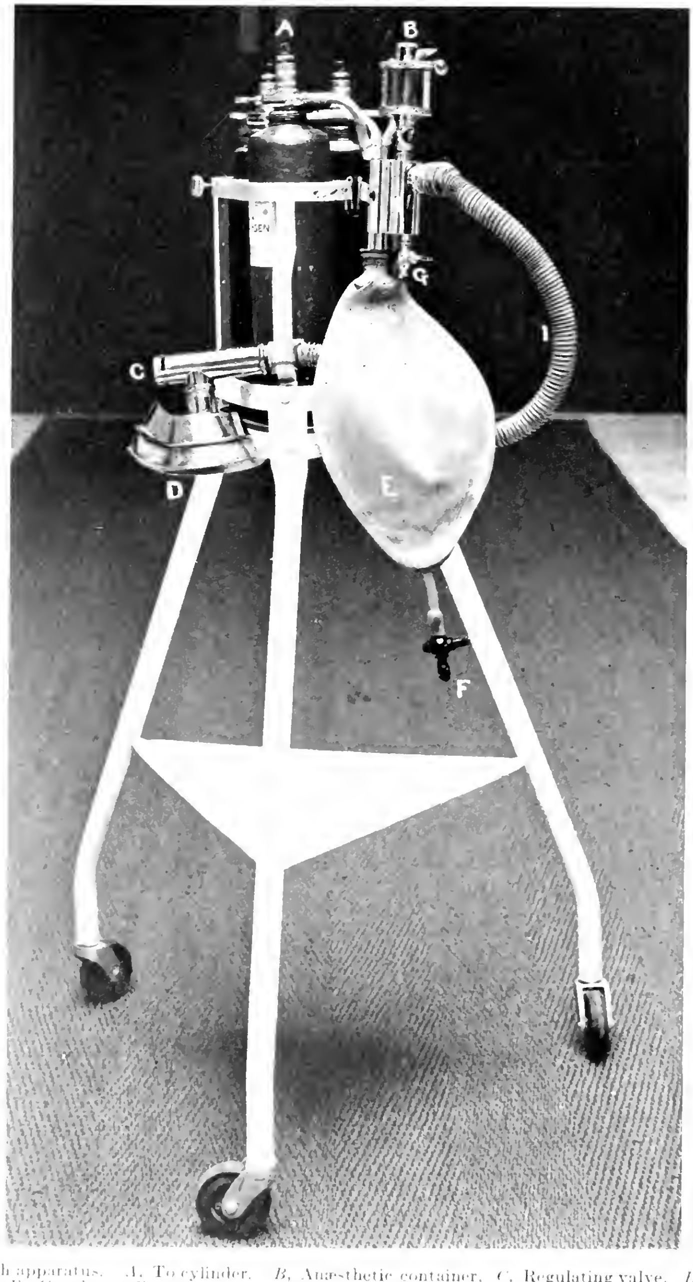
The anæsthetist has complete control of his dosage. There is no guessing nor pouring on, as in the use of the compress, and the administrator may, with a touch of the finger, lessen or increase the amount of the anæsthetic vapor in such a way as to give, or deliver, an even number of drops of either ether or chloroform, or both, per minute, mixed with an even quantity of oxygen and atmospheric air. The administration of the gases is both audible and visible, and, therefore, allows both hands of the administrator free to watch the patient's circulation and other things that may arise; thus it gives him a greater sense of security than any other apparatus now used. The apparent complexity of the Roth-Dräger apparatus and the slightly-increased cost of the narcosis, due to the amount of oxygen needed, are apparent objections to the method, but, as I have already mentioned, the first is not valid, for the apparatus is extremely simple, and the latter should not be allowed to weigh against the diminished risk to the patients. This instrument, however, can hardly be regarded as a portable apparatus, and it is designed largely for hospital use.

Fig. 1.



Double Roth-Drager apparatus for giving mixed narcosis, with oxygen inhalations, at one and the same time. *A*, Indicator as to the number of litres of oxygen used per minute, which is controlled by the thumb-screw *E*. *B*, *B*, Separate reservoirs for ether and chloroform; the cocks, *D* *D*, which control, respectively, the dose of chloroform or ether, or both, administered per minute. *C*, Finimeter showing quantity of oxygen still in the cylinder. *F*, Face mask. *G*, Mixing bag. *H*, Oxygen cylinder. *I*, Bottle-holder. *J*, Basin to hold accessories.

Fig. 2.



Gatch apparatus. *A*, To cylinder. *B*, Anæsthetic container. *C*, Regulating valve. *D*, Face inhaler. *E*, Gas bag. *F*, Stop-cock to bag outlet. *G*, Stop-cock to ether box (*H*). *I*, Outlet tube to face inhaler.

Championnière writes, just to quote the views of men in Europe who are using this apparatus, that the apparatus under consideration permits the delivery of a uniform mixture of oxygen and atmospheric air and a variable quantity of chloroform gases:

"Three litres of oxygen mixed with five litres of air, which is the volume of gas necessary for the breathing of an adult, that is, eight litres pass per minute. Now this combination can be given alone or can be accompanied by an accurately-measured quantity of anæsthetic vapor, according to the wish of the anæsthetist. An increase of the same to the injury of the patient is impossible. The drop-feed is automatic and cannot be exceeded.

"In consequence of the mechanism of a very light and very mobile valve, one hears every respiration of the patient; thus the operator himself is kept continually informed of the progress of the narcosis, of the respiration, and of the working of the apparatus.

"One hears the patient breathing, and this is regarded as one of the surgeon's most valuable securities. We have, then, an apparatus which measures the chloroform to a hair's breadth, secures to the anæsthetist, at every moment, the fullest freedom of movement, and delivers the oxygen with the necessary admixture of air.

"When an operation is ended, the anæsthetist replaces the anæsthetic gas by pure air mixed with oxygen and without altering the position of the patient in any way. It undoubtedly is better than any other method, because it permits the individual freedom of motion on the part of the anæsthetist."

This expresses the opinions of the men in general who have used the apparatus throughout continental Europe.

The Medical Faculty of Bucharest concludes that: *First,* in relation to the old and present methods, it denotes a great step forward by reason of its strict scientific dosing.

Second.—The anæsthesia takes place more slowly than with the compress method.

Third.—It is, moreover, not disturbed by excitability; the periods of excitability are weak and of short duration, and depression of the pulse is never to be detected.

Fourth.—The breathing is thoroughly quiet and regular.

Fifth.—The pupils remain contracted.

Sixth.—The patients retain a rosy face-color, in contrast to the

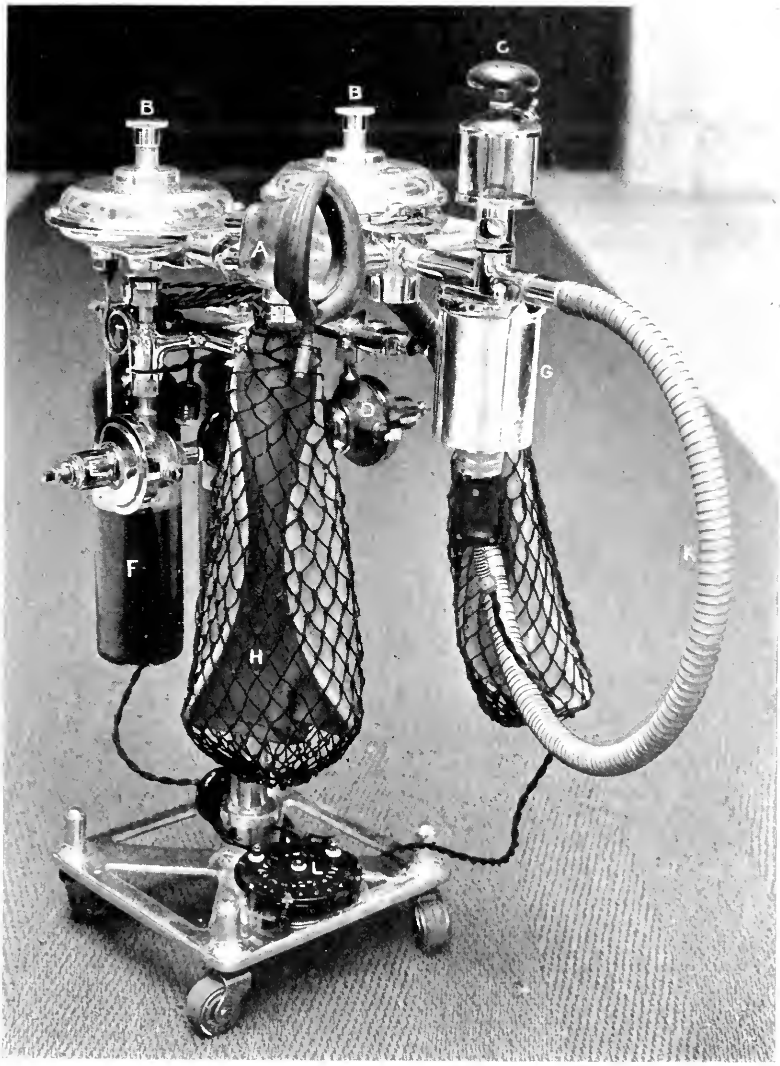
blanched appearance of patients anæsthetized by the compress. Moreover, they show no tendency to syncope. Vomiting occurs comparatively seldom, never during the anæsthesia, with the exception of those cases in which it is interrupted.

Seventh.—The awakening takes place very quickly and completely.

COMPARISON OF THE ROTH-DRÄGER AND ALLIS INHALER ADMINISTRATIONS IN 125 ANÆSTHESIAS IN THE GYNÆCOLOGICAL SERVICE OF JEFFERSON MEDICAL COLLEGE HOSPITAL:

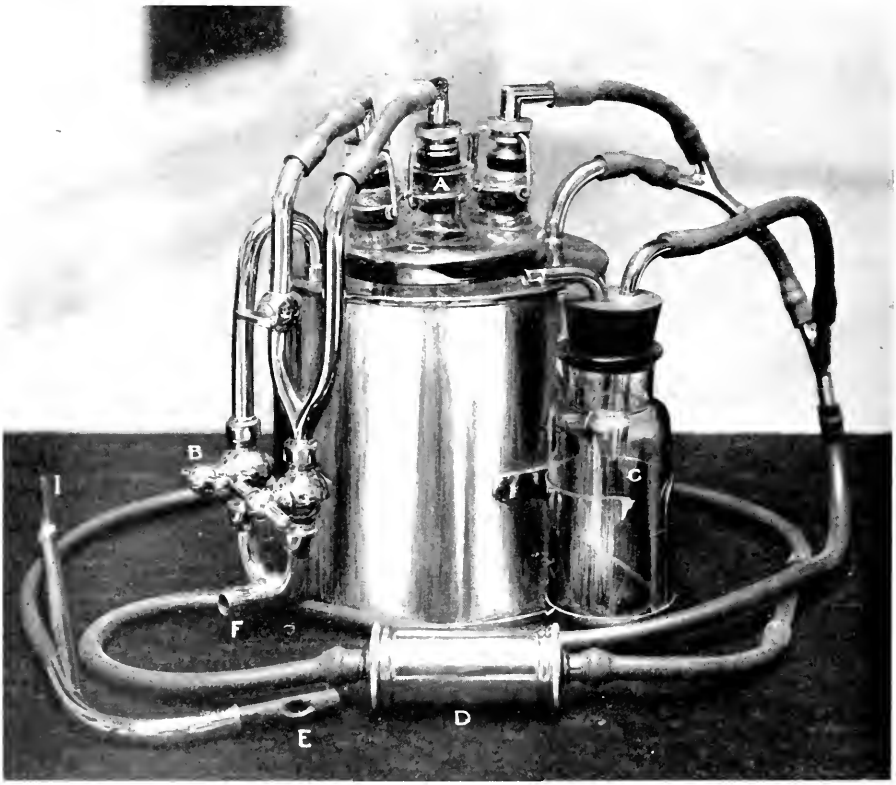
	Inhalers	
	Allis	Roth-Dräger
Average time for surgical anæsthesia or relaxation	14 minutes	14 minutes
Average time for recovery of consciousness	66 minutes	43 minutes
Mucus during administration	59 per cent.	10 per cent.
Postoperative nausea	80 per cent.	39 per cent.
Postoperative vomiting	69 per cent.	30 per cent.
Postoperative headache	11 per cent.	10 per cent.
Postoperative thirst	84 per cent.	80 per cent.
Average amount of ether per patient	7.98-℥	2.97-℥
Average cost of oxygen per patient	$0.62	

FIG. 3.



Ohio monovalve, an apparatus by means of which nitrous oxide may be administered alone, or in combination with oxygen, ether, or chloroform, with warming device. *A*, Face inhaler. *B*, *D*, and *E*, Pressure regulators. *C*, Anæsthetic cup. *F*, One of four gas cylinders. *G*, Electric heater. *H*, Nitrous oxide bag. *I*, Oxygen bag. *J*, Regulating valve for both nitrous oxide and oxygen. *K*, Tube going to face inhaler (*A*). *L*, Rheostat.

Fig. 4.



Ehrenfried apparatus for intratracheal anæsthesia. *A*, Woulffe's bottle to contain the anæsthetic, encased in a water jacket, whereby the interior may be kept at the desired temperature. *B*, Stop-cock, controlling stream of air connecting with foot-bellows, to be attached at the opening *F*, thus permitting the heating of the air and vapor as they pass out of the jacket at *H* and the bottle at *G*. *C*, Bottle containing mercury, which acts as a safety valve and pressure regulator. *D*, Reservoir, packed with gauze, which collects any drops of the anæsthetic which might condense while passing through the tube. *E*, Catheter for insertion into the trachea by means of the staff, *I*. *G*, Short tube of the Woulffe bottle, out of which passes the anæsthetic in the form of a vapor. The V-shaped portion of the apparatus on the left is connected with the bellows, so that the air may be made to pass over, or through, the anæsthetic contained in the bottle, as may be desired by the operator. This is done by a long and short tube; the long tube passes beneath the liquid, so that it must bubble up through it before passing out at *G*, and is controlled by a stop-cock.

DEMONSTRATION OF THE ORIGINAL APPARATUS USED BY JOHN FOSTER BREWSTER FLAGG FOR THE ADMINISTRATION OF ETHER.

BY EDWARD C. KIRK, D.D.S., Sc.D.
Professor of Dental Pathology, Therapeutics and Materia Medica, and Dean of the Faculty of Dentistry, University of Pennsylvania, Philadelphia.

In the matter of ether anæsthesia, it will be remembered that the substance used in the operation by Dr. Warren on October 16, 1846, was designated by Dr. Morton as "Letheon." Within the next few weeks following, Prof. N. H. Bigelow read a paper before a medical society in Boston, going over the subject of ether, and in which he stated that it had been used in the study of its physiological effects by students receiving their medical and surgical training. This article appeared in the November 18, 1846, issue of the *Boston Medical and Surgical Journal.* Within ten days after the publication of this paper—namely, on November 28, 1846—Dr. John Foster Brewster Flagg, of Philadelphia, decided to test the possible anæsthetic effect of the well-known sulphuric ether, and the apparatus used by him was presented to his son, J. Foster Flagg, and by him to the Dental School of the University of Pennsylvania. A book dealing with the administration of ether was published by Dr. J. F. B. Flagg in Philadelphia in 1851—a book replete with interesting references to the history of the subject, and to the physiological effect of ether. Among other points developed are the interesting phenomena of peripheral or superficial anæsthesia induced by small doses continuously administered, as described in the paper by Professor Martin. The apparatus of Flagg, as improvised for use in his initial experiments in 1846, is of interest because of its double inhaling valve, which prevents re-inspiration of the expired ether, vapor, and air. (Fig. 1.) The inhaler is simply an ordinary retort receiver partially filled with sponges, and upon this sponge-mass the ether was poured and inhaled through the inhaling tube. The anæsthetic could be properly administered by this apparatus to-day. A later

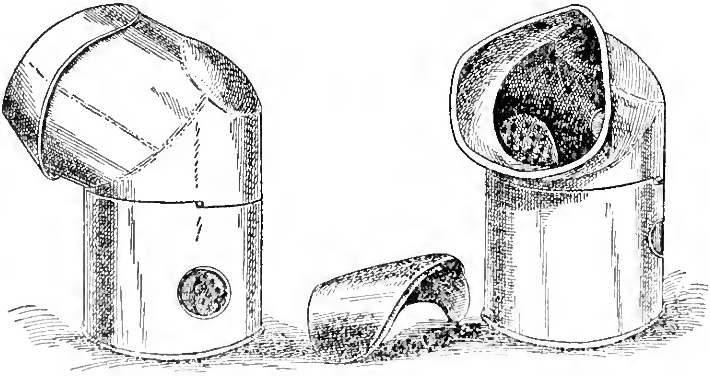
inhaling device of Dr. Flagg's is his portable inhaler, which embodies several features found in quite modern forms of ether inhalers.

Fig. 1.

Drawing made from the original apparatus as used by Dr. Flagg in 1846 for the administration of ether for surgical purposes.

(Fig. 2.) The cover to the inhaler was employed to prevent evaporation, on account of the expense of ether.

Fig. 2.



An inhaler devised by Dr. Flagg for the administration of ether.

In this connection it is interesting to note that a memorial tablet, designed by Dr. R. Tait McKenzie, to the memory of Dr. Crawford

Fig. 3.

Tablet to Dr. Crawford Williamson Long, the first to use ether for surgical purposes.

Williamson Long, who first made use of ether as an anæsthetic for surgical purposes on March 30, 1842, was unveiled at the University of Pennsylvania on March 30, 1912. (Fig. 3.) The following quotations are taken from Dr. Long's account of his personal use of ether[1]:

On numerous occasions I have inhaled ether for its exhilarating properties, and would frequently, at some short time subsequent to its inhalation, discover bruises or painful spots on my person, which I had received while under the influence of ether. I noticed my friends, while etherized, received falls and bangs, which I believed were sufficient to produce pain on a person not in a state of anæsthesia, and on questioning them they uniformly assured me that they did not feel the least pain from these accidents. These facts are mentioned that the reasons may be apparent why I was induced to make an experiment in etherization.

The first patient to whom I administered ether in a surgical operation was Mr. James M. Venable, who then resided within two miles of Jefferson, and at present (1849) lives in Cobb County, Georgia. Mr. Venable consulted me on several occasions in regard to the propriety of removing two small tumors situated on the back of his neck, but would postpone, from time to time, having the operations performed, from dread of pain. At length I mentioned to him the fact of my receiving bruises while under the influence of the vapor of ether, without suffering, and as I knew him to be fond of and accustomed to inhale ether, I suggested to him the probability that the operations might be performed without pain, and proposed operating on him while under its influence. He consented to have one tumor removed, and the operation was performed the same evening. The ether was given to Mr. Venable on a towel, and when fully under its influence, I extirpated the tumor. It was encysted and about one-half inch in diameter. The patient continued to inhale ether during the time of operation, and when informed it was over, seemed incredulous, until the tumor was shown him. He gave no evidence of suffering during the operation, and assured me after it was over that he did not experience the slightest degree of pain from its performance. This operation was performed on March 30, 1842.

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[1] Buxton's article on Long, *Proceedings of the Royal Society of Medicine*, January, 1912, as quoted by Prof. John Chalmers DaCosta in his oration on Long at the unveiling of the tablet.

POSTANÆSTHETIC POISONING[1]

BY EDRED M. CORNER, M.B., M.C., F.R.C.S.

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I WOULD remind you that this hospital has not only for its object the treatment of children, but has also the business of trying to advance our knowledge of children's illnesses. In consequence, at the present time, investigations are being made into the condition of postanæsthetic poisoning. The first thing to ascertain was the amount of material on which to base an inquiry. The instances resolve themselves into fatal and non-fatal cases. Of the fatal cases of so-called delayed chloroform poisoning, 13 in number were found. One fatal case was after manipulations for congenital dislocation of the hip. Three cases occurred after an anæsthetic was given for the operation for the radical cure of inguinal hernia. There was one case after an anæsthetic for the removal of tuberculous glands of the neck. There were two cases after the operation for the removal of the appendix. There was one after an operation for mastoiditis. There was one case after the incision of a psoas abscess, and three recent examples of fatal incidence of postanæsthetic poisoning after the removal of tonsils and adenoids. Indeed, after perhaps the most common operations, removal of tonsils and adenoids, the radical cure of inguinal hernia, or the removal of the appendix, these cases of postanæsthetic poisoning occurred.

This shows of what very great importance the subject is. Besides these fatal cases, we have learned to recognize a far larger number of non-fatal cases; so that the material at our disposal consists of thirteen fatal cases and a large number of non-fatal ones. Having thus premised the object of this lecture and the materials on the study of which it is based, I will briefly indicate to you what the condition itself is.

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* A lecture delivered at the Hospital for Sick Children, Great Ormond Street, London, W. C., February 15, 1912.

The symptoms, present in a greater or less degree in all cases, were vomiting, which began at a variable time after operation; mental irritability, even amounting at times to delirium; inability to eat or drink, air-hunger, collapse as evidenced by a rapid, feeble, and intermittent pulse, an ashen color of the face, and sunken eyes, convulsions, Cheyne-Stokes breathing, and, later on, coma. The bowels, as a rule, were open. In severe cases diarrhœa was present. Acetone was always present in the breath and in the urine. The temperature was elevated, between 101° F. and 105° F., in all cases, with a tendency to sudden rise of temperature before death, the preagonal rise, in one case, amounting to 107.6° F. Two of the fatal cases showed evidence of slight bronchopneumonia at the bases, but this was probably a condition occurring just before death. The symptoms in the cases which recovered and in those which died were similar, except in severity. At times these cases vary a great deal, the children sometimes appearing to be recovering, when vomiting would suddenly begin again, and the child would die in a few hours. In other cases, the child being extremely ill and apparently about to die, the vomiting would cease without any apparent reason, and the child from that time onward would mend. It will be seen, from the description of the illness in these children, that it is extremely difficult to give a reasonably accurate prognosis. From the amount of acetone in the urine it was found that no prognosis could be based. With regard to the general symptoms, again it was very difficult to give a prognosis, because there is no doubt that in cases which are bad, if they suddenly began to vomit again the vomiting starts a reflex vagus inhibition of the heart and they die of cardiac failure, and it is impossible to predict the incidence of the sickness. It was noticed that if in the early stages there was plenty of sickness and it was followed by the cessation of the sickness the general symptoms very rapidly improved. Similarly it was found that if the bowels were well opened at the beginning the general symptoms improved, but if the activity of the bowels went on to diarrhœa, then the prognosis was bad; the progress of the case seeming to bear a distinct relation with regard to the action of the bowels or the sickness, suggesting that by means of the sickness or the action of the bowels the patient was getting rid of some of the poisonous matter or matters. Beyond that, I do not think there is anything particular to be said with regard

to the prognosis, with the exception that a sudden rise of temperature frequently denoted that the child was about to succumb.

Then with regard to the treatment which was pursued in these cases: In all the cases glucose and bicarbonate of soda were given freely. Glucose was given by the mouth, one drachm three-hourly; by the rectum, half an ounce four-hourly. Or, if the child had vomiting and diarrhœa and the substance could not be given by the mouth or rectum, it was given by the subcutaneous injection of a 2½ per cent. solution of glucose, between six and ten ounces being given at a time. Bicarbonate of soda was given by the mouth in doses of ten to twenty grains every six hours; by rectum, thirty grains every six hours. If it was given subcutaneously it was given in a 2½ per cent. solution. If the administration of these drugs by the mouth was impossible, nasal, rectal, or subcutaneous administration was attempted. Fluids were given constantly by rectal, subcutaneous, or intravenous methods. Continuous inhalation of oxygen was employed. A variety of drugs was used, among which may be mentioned atropine, adrenalin, pituitary extract, and brandy, whilst cyanosis with cardiac dilatation was taken as an indication for leeching or venesection. From a study of three temperature charts of patients succumbing, the first shows that the child's bowels were open, but it shows a sudden rise of temperature which occurred immediately before death. In that case the bowels were opened once daily. In the next case you will see at the fatal termination of the illness the temperature did not go so high as even in the last one.

We have now carefully considered the history of the disease, the symptoms, the prognosis, and the treatment adopted, and from that point we can go on to ascertain what has been known by other authors with regard to the condition of so-called delayed chloroform poisoning.

Delayed chloroform poisoning was first described in this country by Leonard Guthrie, in 1894. Since then the condition has attracted a good deal of attention, without, however, any marked advance being made in our knowledge of its causation or prevention.

The conclusions of the various writers on the subject may be summarized as follows: First, children are far more commonly affected than adults, but the condition is known to occur in adults. Secondly, the cases of delayed chloroform poisoning are exceedingly various; the only factor which is known to have been common to all

cases is the administration of an anæsthetic. This anæsthetic, in the great majority of cases, has been chloroform. But there are cases on record where the condition of so-called delayed chloroform poisoning has followed the use of other anæsthetics, such as ether, a mixture of chloroform and ether, ethyl chloride, or even nitrous oxide gas. Thirdly, there would appear to be an universal agreement among all investigators that the condition is an expression of acid intoxication, the fatty acids being set free in the blood, and that acetonæmia and acetonuria are invariable phenomena in the patients affected. Fourthly, the essential cause or causes of this acid intoxication are at present unknown, but various antecedent or contributory factors have been suggested. Guthrie has suggested the previous existence of a fatty liver; Stiles and Macdonald, the prolongation of anæsthesia and the existence of sepsis; Wallace and Gillespie, the presence of a septic focus (present previously to the anæsthetic) in the body. Other authors have referred to a history of cyclic vomiting. Fifthly, starting from the basis of acidosis, various writers have suggested as prophylactic the administration of carbohydrate (glucose), and the treatment of the condition, when it exists, with large doses of bicarbonate of soda. That, roughly, is a very short summary of what is generally accepted among the workers on this subject.

At this hospital inquiries have been made into a number of points, which I may briefly mention. First, as to whether the quality of the anæsthetic used had any influence on the occurrence of the condition of so-called delayed chloroform poisoning, the suggestion naturally being that if some decomposition product had formed in the chloroform, that decomposition product would be administered with the chloroform and might be a very toxic substance, producing the postanæsthetic poisoning. At this hospital we use the chloroform made by Duncan and Flockhart, of Edinburgh, and the condition of delayed chloroform poisoning has been found to occur in the administration of all three varieties of chloroform which this firm produces; that is to say, black-label chloroform, red-label chloroform, and blue-label chloroform. Each of them has been analyzed carefully, inquired into and found to be pure. So it was found that postanæsthetic poisoning could occur after the administration of pure anæsthetics. Secondly, inquiries were made as to whether the duration of the anæsthesia had any influence; in other words, roughly,

the quantity of drug employed. There we found that nothing constant could be ascertained. For instance, by far the greatest number of cases of "delayed chloroform poisoning" which passed under our notice occurred after the operation for removal of adenoids and tonsils, which requires a very short anæsthesia. On the other hand, anæsthesias lasted one or two hours and were not followed by "delayed chloroform poisoning." So it would appear that the duration of the anæsthesia, and therefore, roughly, the quantity of the drug employed, does not exert an obvious influence on the incidence of this disease. Inquiries were made to see if the nature and duration of the operation had any effect on the condition, and, so far as could be found, it had not. It occurs, and perhaps most frequently of all, after the operation for the removal of tonsils and adenoids. But it also occurred when there was not even an incision made, as after the manipulations for congenital dislocation of the hip. So that with regard to any influence that the nature and duration of the operation might have it was found that the condition was so variable that it was impossible to draw any inference. Then inquiries were made with regard to the fourth point, the possible influence of sepsis which has been suggested. Sepsis may influence a patient in two ways. There may be a septic process *before* operation, such as a chronically inflamed suppurating tonsil, or there may be sepsis present *after* an operation. There is no doubt that apparently the presence of sepsis did render these children who had an anæsthetic more liable to the condition of postanæsthetic poisoning, and it was found that the presence of a septic focus in the body before operation was infinitely more important than suppuration after operation.

Then comes the relation of the liver lesions to acidosis and to acid intoxication. A marked fatty condition of the liver is a constant feature in these cases of "delayed chloroform poisoning" which come to autopsy. Hence, in any inquiry on this subject, attention must be given to these liver lesions. It is known experimentally that chloroform itself can produce such change in the liver and, in common with that, acetonuria. Both those changes, the fatty liver and the acetone in the urine, may result from starvation, and some authorities have been tempted to ascribe the symptoms produced or accompanying those conditions to physiological incompetence of the liver tissue. The histological features of sections of fatty livers,

both from children who die of postanæsthetic poisoning and of those dead from a variety of other causes, have been carefully examined, and no essential differences have been detected which could justify the attribution of any importance to the fact that fatty degeneration of the liver is more than a constant feature in cases of postanæsthetic poisoning. It is constantly present in such cases, but is also known, and sometimes in even more marked degree, in cases where the manner of death has in no way suggested the peculiar phenomena which invariably characterize the clinical course of delayed chloroform poisoning. The fatty degeneration of the liver is probably the direct result of the absorption of chloroform, or poisons derived from its metabolism, from the bowel. These chloroform toxins may have either been swallowed, such as in mucus from the mouth while the anæsthetic is being administered, or these chloroform toxins may be excreted into the stomach, whence some are ejected by vomiting and others pass into the intestine. It will be remembered with regard to morphine, for instance, we know that it is a drug which is excreted partially into the stomach, and one would suggest the possibility of this excretion into the stomach of some such products which result from the absorption of chloroform. Those products excreted in the stomach will go down into the intestine and be absorbed further by the portal system, producing fatty degeneration in the liver-cells. It is known that chloroform can produce fatty degeneration in the liver-cells. As a result of this change in the liver, the altered metabolism must add to the intoxication. The suggestion that a previously-existing fatty liver is the determining factor in delayed chloroform poisoning, explaining why some children get it and some do not, can neither be proved nor disproved, but is, from an inquiry into a long series of cases and of post-mortem records, unlikely. Again, it must be remembered that we can have severe acetonuria without the co-existence of a fatty liver, and that extreme grades of fatty degeneration of the liver are met with—for example, in rickets—without any acetonuria or symptoms of acid intoxication being present.

The next points investigated were the relationship of acetonuria to postanæsthetic vomiting, the incidence of mild, non-fatal forms of chloroform poisoning, and the effect on the occurrence of postanæsthetic acetonuria of the administration of a carbohydrate. Many peo-

ple have urged that glucose was a preventive, and so inquiries were conducted to see to what extent that was true.

Before I go on with this I might mention the test which was used for the detection of acetone in the urine. A portion of the urine was poured into a test-tube and mixed with an equal quantity of saturated solution of sulphate of ammonia. To this were added a few drops of the liquor ammonii fortior of the British Pharmacopœia. After that, were added a few drops of 5 per cent. solution of sodium nitroprusside. If acetone was present the solution became a red color, changing to reddish-violet in from one to three minutes. That test may be varied in many ways. For instance, the liquids may be run into a test-tube so that they do not mix, the red color appearing as a ring at the junction of the urine and ammonium sulphate solution, or the urine and the ammonium sulphate solution or sodium nitroprusside mixed, and a few drops of liquor ammonii fortior allowed to fall on its surface, when the red color will develop. All the tests used in this connection were based on the one described.

With these powers at our disposal, an investigation was begun into the occurrence of this acetonuria, and almost at once an extraordinary fact was brought to light. The mere admission of a child to the hospital could induce acetone to appear in the urine: why or wherefore is yet to be found out. But specimens of urine were examined as soon as possible after admission and twenty-four hours later. In the first specimen there would be no acetone, but in the second—that is to say, taken twenty-four hours after residence in the hospital—acetone would be detected in the urine. It was found that the mere admission into hospital produced acetonuria in 36 per cent. It was then tried, as it was a good opportunity, to see if the administration of glucose immediately on coming into the hospital would interfere with this development of acetone in the urine, because if glucose is to be of any use to us in treating these cases it should give its effect in these instances. It was found that of the children who were given glucose about 32 per cent. developed acetone in the urine, while of those who had no glucose 34 per cent. developed it in the urine, suggesting, though not based on a large enough series of cases, that the administration of glucose may have a small effect, not a large one, in preventing the development of acetone in the urine. Then the urine was examined after the administration of an anæsthetic, and it

was found that after an anæsthetic no less than 72 per cent. of children developed acetone in the urine. Further, it was found that if they were given glucose 70 per cent. developed acetone in the urine, and of those who had no glucose 73 per cent. developed acetone in the urine, again suggesting that the administration of glucose had a small and definite effect in preventing the appearance of acetone in the urine.

Then an inquiry was made as to which anæsthetic produced acetone in the urine more often than others. When chloroform was administered alone it was found that 67 per cent. of children developed acetone in the urine, but when the chloroform was mixed with ether the percentage of those who developed acetone in the urine rose to 86 per cent. Of the cases which received ether only, we found 66 per cent. developed acetone. So it is perfectly definite that the condition of acetonuria is really a very common one, and until these inquiries were made it was not appreciated in any way that it was so common. What, then, is its relation to the uncommon condition of postanæsthetic poisoning? If, before this inquiry, we had been asked if such things ever occurred we should have said that they never occurred. So it is an example to you of the great fallacy that may be fallen into by merely relying on memory.

Severe vomiting, of itself, is known to be able to produce acetone in the urine. So inquiries were made into the sickness after anæsthetics. Chloroform, which is the chief offending anæsthetic in producing delayed chloroform poisoning, was found to be also the anæsthetic which was followed by most vomiting. In the cases examined chloroform caused vomiting more frequently than any other anæsthetic. At the same time, it is the drug which is most often concerned in postanæsthetic vomiting. So that between the administration of chloroform and the occurrence of "delayed chloroform poisoning" there is a vicious circle. While conducting these inquiries one had the opportunity of seeing if the administration of glucose had any influence on the postanæsthetic sickness. And there we found, if it had any effect at all, it was to increase very slightly the frequency of postanæsthetic sickness.

Another point which was noticed was that the illness of "delayed chloroform poisoning" was more frequent between three and eight years of age than either before or after that age. Subcutaneous injec-

tions of atropine were used before the induction of anæsthesia to prevent the formation of mucus in the mouth and the subsequent absorption of the drug swallowed, and had no influence in preventing the symptoms of delayed chloroform poisoning. It is possible that the anæsthetic in part is excreted into the alimentary canal and reabsorbed from it. Therefore it makes but little difference if the drug is absorbed from the lungs or swallowed.

It is clear that a large proportion of children develop acetonuria merely as the result of the altered condition which admission into hospital entails. The real causation is uncertain, but there is reason to believe that the change in the diet or the refusal to take food, which so often follows their admission, are the chief factors. And, further, it must be noted that the addition of glucose to the ordinary diet made little difference to the incidence of the acetonuria. The administration of an anæsthetic caused the appearance of acetone in the urine in the majority of cases, 72 per cent. in the wards and practically 100 per cent. of the cases in the out-patient department. Here, again, the previous administration of glucose made no great difference to the incidence of the symptoms. Only few who developed acetonuria after the operation showed any other symptoms. Further, no patient who had already had acetone in the urine before the anæsthetic was administered showed any recognizable sign of increased intoxication.

The problem of the occurrence of delayed chloroform poisoning is a very difficult one, and so long as it is necessary to produce anæsthesia by the administration of a poisonous drug such as chloroform, so long will cases of delayed chloroform poisoning occur. In other words, if we have to administer chloroform 100 times, we are absolutely bound among those 100 cases to have a case of "delayed chloroform poisoning." There is one very useful thing which I must not omit. For some time in my ward here we have been giving these children, before the anæsthetic, some injections of morphine and atropine, and that has been found to be very successful. The children have an injection of morphine and atropine three-quarters of an hour before operation, and require much less anæsthetic. To make it more practical I will give you the doses; morphine injection of the pharmacopœia of this hospital is of the strength one grain to 40 minims; that is about half strength of the solution of the British Pharmacopœia. And we give it in the proportion of 1 minim to a

child of one year, 2 minims to a child two years of age, and so on. The atropine injection of this hospital is of the strength of one grain to 400 minims; that is to say, one-quarter the strength of the corresponding solution in the British Pharmacopœia. The usual doses are as follows: if the child is over five years of age, 4 minims; four to five years, 3 minims; three to four years, 2 minims. Up to three years old we give 1 minim to 2 minims. In that connection it is of interest to note that children seem to bear this drug with great tolerance, because to a child five years old we administer 1/100 grain, which is the full dose for the adult recommended by the British Pharmacopœia. A child of five takes that dose excellently.

In conclusion, it will be understood that the occurrence of this condition of delayed chloroform or postanæsthetic poisoning is a necessary result from the administration of a poisonous drug to produce anæsthesia. We cannot escape the occasional occurrence of the condition of "delayed chloroform poisoning" so long as we administer such a drug to produce anæsthesia, and the only power we have is to minimize the frequency of its occurrence. In the preparation of the patient the normal habit of life should be changed as little as possible, and one should particularly avoid purgation and those periods of abstinence from food (or starvation) which commonly form a part of the rule of preparing for an anæsthetic. As small a quantity of the anæsthetic should be administered as possible, and after it has been administered every opportunity should be given for the excretion of the drug which has been absorbed. The activity of the bowels should be maintained and stimulated, sickness should be rather encouraged than checked, the skin should be made to act, and by diuretics the elimination of the poison through the kidneys should be induced and encouraged.

THE CASE AGAINST THE NURSE-ANÆSTHETIST

BY LAWRENCE IRWELL, M.A., B.C.L.
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At the last conference of the American Hospital Association, some discussion occurred as to the legality of the administration of anæsthetics by nurses. Dr. Willis G. Neally, of New York, although advocating the employment of nurse-anæsthetists, if legal, said: "In some States it is illegal for a nurse to give an anæsthetic, and it is a question if it is legal in many States, New York included, for a nurse or anyone not a licensed physician to do so."

The medical practice laws of New York, Ohio and Illinois are very similar. Further, the clauses defining the practice of medicine in the statutes of these three States are, for all practical purposes, identical, the clause in the statute of the first-named State being as follows:

> A person practises medicine within the meaning of this act who holds himself out as being able to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity, or physical condition, and who shall either offer or undertake by any means or method to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity or physical condition.

The medical practice laws of New York, Ohio and Illinois contain no reference to nurses, consequently a nurse is in exactly the same position as any other person who is not a licensed physician. If it is legal for a nurse to give an anæsthetic, it is equally legal for an orderly or an ambulance driver to give one, provided a licensed physician is present. The popular idea that a nurse is a sort of lower grade doctor of medicine, and is at liberty to do certain acts which would be illegal if done by those who are neither physicians nor nurses, is a fallacy. It is true that a few nurses have a stock of "eminent physicians'" prescriptions which they try to induce their friends to take whenever those friends present symptoms which, to the nurse's mind, indicate need for some particular drug, or combination of drugs, but no physician defends this practice, which is by no means common.

So long as a nurse simply carries out the instructions of a physician, she is complying with the law and is doing her duty. If the physician in attendance upon a patient leaves the city for a few days, the nurse may give medicines in such doses as the doctor has ordered before his departure. But the moment that the nurse exercises her own discretion by changing the doses or by ceasing to give the medicine, or by employing some form of treatment not prescribed by the physician, she practises medicine in the legal sense of the words, and violates the law. No physician is justified in saying to a nurse "if such-and-such symptoms appear, give the patient five grains of ——." A nurse possesses no qualifications for forming an opinion as to whether these symptoms have appeared, unless they are very marked. To form an accurate opinion upon technical matters of this character requires a medical education and a physician's experience.

If the administration of a general anæsthetic required neither skill nor special knowledge; if it merely consisted of turning certain knobs or handles whenever the operating surgeon gave the word, then it might be legal for any adult to administer an anæsthetic. But this is not by any means the case. No nurse is allowed to give any anæsthetic until she has received special instruction in the art of so doing. She is expected to acquire sufficient medical information to know the details concerning the respiration of the patient while under the influence of the drug, the appearance of the eyes and the state of the skin, as well as character of the pulse. In other words, she is expected to become familiar with certain strictly medical facts without mastering the necessary preliminary data, without having taken a medical course, without being thoroughly conversant with physiology, and without having any technical knowledge of pathology before she is permitted to act as an anæsthetist. Could anything be more unreasonable, or more dangerous to the patient? Would it not be as reasonable to allow a man (or woman) to become a dermatologist without first obtaining a license to practise medicine? In both cases accurate knowledge of the general condition of the patient is necessary. Having obtained a modicum of medical information, the nurse-anæsthetist administers the anæsthetic and controls the quantity that is given. The surgeon devotes his attention to the operation. This is the usual procedure. If, however, the surgeon attempts to watch the patient's symptoms, to instruct the nurse as to the administration of the anæs-

thetic, and also to operate, it is obvious that the operation cannot be performed in the best possible manner, for no man is capable of attending to all these matters at once, and an injustice is done to the patient. Nevertheless, those surgeons who employ a non-medical anæsthetist generally justify their action by contending that their presence makes their method legal; that the nurse-anæsthetist merely obeys orders, and that, in reality, she only provides an additional pair of hands. To this argument—if this term can correctly be applied to such an invalid contention—the obvious answer is: Why, then, does the nurse-anæsthetist require special training; why is it necessary for her to recognize certain "danger signals"; why must she be familiar with what constitutes a patient's normal condition when under the influence of an anæsthetic?

The moment that a nurse of her own volition, in consequence of symptoms observed by her, increases or decreases the amount of an anæsthetic which is being given to man, woman or child, she unquestionably and beyond doubt practises medicine in the legal sense of the words and violates the law of New York, Ohio, or Illinois, as the case may be. And this is a most liberal interpretation of the law, for in all probability it is illegal for a nurse to administer a general anæsthetic in any circumstances—even if she has been instructed beforehand to give a fixed quantity for a certain period.

It is argued that custom has made legal the employment of the nurse-anæsthetist, and it must be admitted that this argument might carry some weight if the custom had been universal for a great number of years. Not only is the custom comparatively uncommon, but, in addition, it is chiefly to be found among surgeons who are nowhere near the first rank, and are quite unknown outside the localities in which they live. How long the nurse-anæsthetist has been employed—in what year some surgeon got the idea that he could make money by employing a nurse at a salary to give anæsthetics—cannot be ascertained. The custom does not exist in England, and in that country any surgeon who employed as anæsthetist a person who was not a registered physician would find that the British Medical Council would take steps to remove his name from the medical register as soon as the facts became public. The argument that some surgeons have for a number of years employed nurses as anæsthetists, although admissible as evidence, has little value.

Some physicians have for years performed abortions. This does not legalize the acts of those physicians. The fact that some surgeons have for a decade or more used nurses to give anæsthetics, and that those nurses have not been prosecuted, does not make the practice legal. In other words, this is not a matter in which the doctrine of "custom of the trade" is applicable. Indeed, that doctrine has little bearing where the criminal law is involved.

A considerable number of nurse-anæsthetists have been to Cleveland, Ohio, to learn Dr. Crile's method of administering an anæsthetic—usually nitrous oxide-oxygen. This method seems to necessitate the use of elaborate apparatus which Dr. Bevan (of Chicago) has denounced as useless. "The simple, cheap stands for gas-tanks and face-masks are much to be preferred," says Dr. Bevan.[1] Whether Dr. Crile employs a physician or a nurse as anæsthetist is not known to the writer, but after the distinguished Cleveland surgeon has seen the following letter, signed by the secretary of the Ohio State Medical Board, he ought, as a matter of ordinary good citizenship, to prohibit the training of nurses by his assistants in the art of administering anæsthetics. It is almost unnecessary to add that he should obey the law of Ohio as interpreted by its attorney-general. These words are not intended to convey the impression that Dr. Crile employs, or has ever employed, a nurse as anæsthetist. As has been stated above, the writer has no information on that subject. They are intended to convey the impression that if Dr. Crile *does* employ a nurse as anæsthetist, he should now cease to do so.

"State of Ohio.
"The State Medical Board.
"COLUMBUS, OHIO, Jan. 22, 1912.

"The Board passed a resolution in which it expressed the opinion that no one other than a registered physician could administer an anæsthetic. This was referred to the Attorney-General for an opinion, which opinion entirely coincides with that of the Board, so that it is not only unethical but illegal for persons other than registered physicians to administer anæsthetics.

"Very sincerely,
"GEO. H. MATSON, Secretary."

The *New York State Journal of Medicine* for December last (1911) contains the emphatic opinion of Mr. James Taylor Lewis,

[1] *Dietetic and Hygienic Gazette*, January, 1912, p. 53.

counsel of New York State Medical Society, that the administration of an anæsthetic by a nurse is a violation of the law of the State of New York. That Mr. Lewis is strongly opposed to the practice may be learned from the following excerpt from a letter signed by him and dated February 29, 1912: "I am firmly convinced that if the practice exists of allowing probationary, undergraduate or even graduate nurses to administer general anæsthetics incident to surgical operations, such practice is a menace to the public health and should be immediately abandoned."

There is no doubt that a few nurses have been trained to give anæsthetics in a satisfactory manner, and that some nurses can be trained to do this work. Similarly, some butlers who can carve with remarkable skill and accuracy can probably be taught to perform minor surgical operations. But these facts prove nothing of importance. Any surgical operation requiring anæsthesia must be classed as dangerous, and the anæsthetic increases the danger. The laws of most States, for the protection of persons who require medical or surgical aid, and with the object of reducing risks to life and health incident to medical treatment and surgical operations, have provided that only those men and women who have received a complete medical education may practise medicine or surgery; and the doctrine that certain individuals who are not licensed physicians can learn to perform some medical or surgical acts does not prove that they can repeatedly perform those acts without unnecessary peril to patients whose condition makes anæsthesia necessary.

The secretary of the General Hospital in this city (Buffalo, N. Y.) informs me that although no surgeon is at this institution permitted to make use of a non-medical anæsthetist when the hospital patients are being operated upon, yet one of the surgeons is allowed to use, and does use,[2] a nurse-anæsthetist for his own private patients who pay for room and nurse, etc. The explanation of this is that, in case of death of the latter class of patient under anæsthesia, no suit against the hospital could be sustained—at least so says the learned secretary. But if a charge is made for the use of the operat-

[2] It is only fair to add that the hospital's counsel has given an opinion that the employment of a nurse as anæsthetist is legal. On the other hand, James Taylor Lewis, Esq., the counsel of the New York State Medical Society, has delivered an opinion that nurses giving anæsthetics in the State of New York are within the pale of the law.

ing room, and if Mr. Lewis' opinion is correct that the administration of an anæsthetic by a nurse is, in this State (N. Y.), a violation of the law, the courts might possibly take a different view. Legal matters aside, however, how many paying patients would submit to non-medical anæsthetization if they were told that it is probably illegal? What kind of conscience has the manager of a hospital who forbids the employment of a nurse-anæsthetist where the hospital's patients are concerned, but allows it in the case of paying patients, most of whom would be glad to have the services of the most skilled physician-anæsthetist in the city if all the facts were brought to their attention?

Surgeons who employ nurses as anæsthetists are not true friends to those nurses, for their usual method, although not their invariable method, is to pay the nurse a comparatively small salary, but to charge for the anæsthetic as much as the patient is at all likely to be willing to pay, and quite as much as a physician who makes a specialty of giving anæsthetics would charge. In other words, the surgeon employs a nurse as anæsthetist because he finds it financially profitable to do so—and for no other reason. Speaking generally, such surgeons should be avoided by persons requiring operations until a judicial decision upon the subject has been obtained, and self-respecting nurses should, until that time, turn their attention to other matters—perhaps to urinalysis.

Surgery

DIRECT METHODS OF EXAMINATION OF THE LARYNX, TRACHEA, BRONCHI, ŒSOPHAGUS, AND STOMACH*

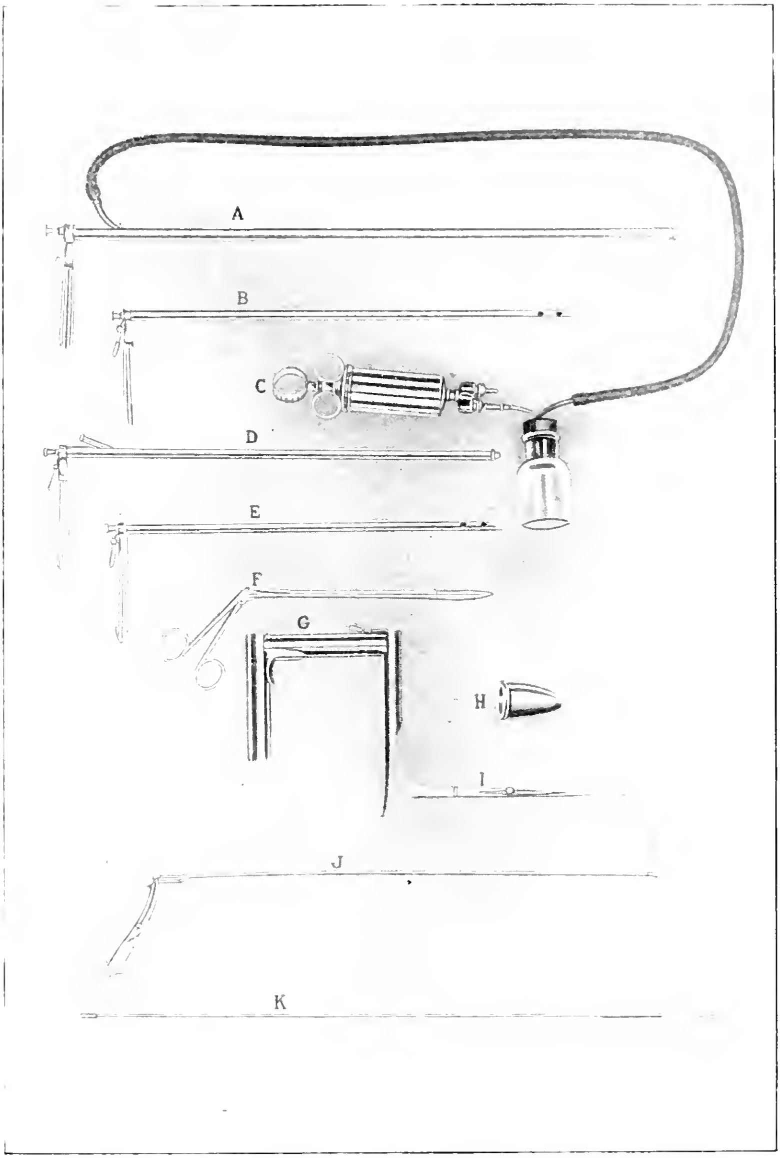
BY CHEVALIER JACKSON, M.D.
PITTSBURGH, PA.

THE physician of my youth practised internal medicine with the aid of a prescription blank and a desk. His was a judicial mind which weighed the evidence as given by the patient's history. The education of the eye was limited chiefly to inspection of the facies, the fauces, and the tongue, while the education of the touch was largely concerned with the detection of minute differences in radial pulsations. To make a visual gynæcologic examination was by many considered as a fussy pretension bordering on quackery. A few men, natural born diagnosticians, made brilliant diagnoses, but usually quite late in the disease. Slowly, but surely, this old method of diagnosis by deduction has given way to methods of direct inspection. In a few regions, exploratory operations are necessary for a viewing of the parts, but in many regions newly-developed instruments and technic enable direct inspection through natural passages of the body. The latest additions to the regions open for direct inspection are the bronchi and the stomach. The œsophagus has been explored with the œsophagoscope for thirty years, but only to a limited extent. Imperfect methods of illumination deterred lengthening the œsophagoscope to inspect the stomach in a practical way, until the technic was developed by the speaker. Early œsophagoscopists unintentionally entered the trachea through the larynx and hastily withdrew. It remained for Killian to demonstrate the feasibility of introducing a tube through the mouth into the bronchi for the finding and removal of a foreign body. In the search for foreign bodies, lesions were discovered, and another method, bronchoscopy, was thus added to our means of diagnosis by direct inspection.

Definition.—Direct laryngoscopy, tracheobronchoscopy, œsoph-

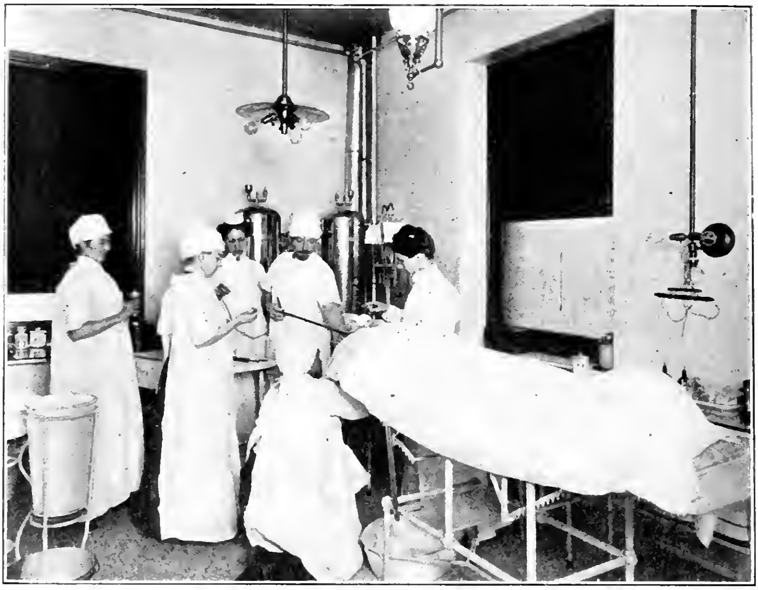
* Lecture, with lantern demonstration, delivered before the Kings County Medical Society, Brooklyn, New York, December 19, 1911.

Fig. 1.



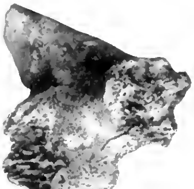
Instruments for direct laryngoscopy, bronchoscopy, œsophagoscopy, and gastroscopy.

FIG. 3.



Passing the œsophagoscope. The gastroscope is passed in the same way.

FIG. 5.



Pork bone removed from œsophagus, bloodlessly, through the mouth, by œsophagoscopy. (Actual size.) (Case 1.)

FIG. 6.

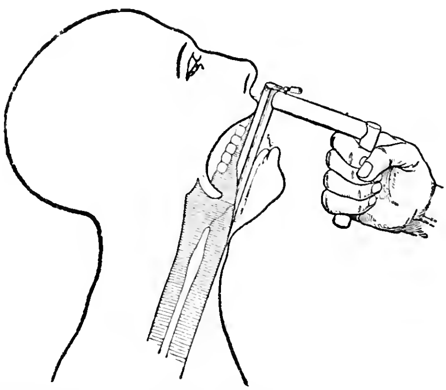
"Job's tear" removed from right bronchus of a 5-months-old infant, bronchoscopically, through the mouth. (Case 3.)

agoscopy, and gastroscopy are procedures using tubes which serve as specula in bringing into view, respectively, the interior of the larynx, trachea, bronchi, œsophagus, and stomach. These tubes hold out of the way tissues that normally obstruct the view of these passages, or they drag the passages into a new position in the line of sight.

Purpose.—The removal of foreign bodies and the diagnosis and treatment of disease.

Instruments.—The instruments seen in Fig. 1 are called, respectively, a slide-speculum, a bronchoscope, an œsophagoscope, and a gastroscope, the latter two having an aspirator connected with an auxiliary canal in the wall of the tube. The accessory instruments

FIG. 2.



Schema showing the slide-speculum in position for direct inspection of the larynx. This is also the first step in bronchoscopy, as the bronchoscope is easily inserted through the speculum, though the patient is usually recumbent for bronchoscopy.

are sponge-holders for clearing the field of secretions, taking smears, etc.; forceps for the removal of specimens and foreign bodies; and many accessory instruments for special cases.

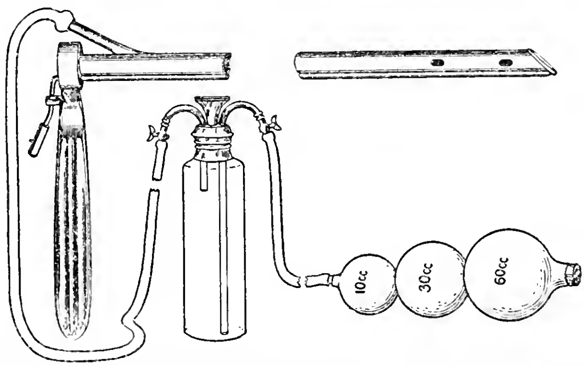
Technic.—When we consider the turns of the air-passages from the lips to the bronchi, it may seem impracticable to insert a straight tube therein. But it must be remembered that the walls of these passages are very flexible and elastic. For instance, it is quite easy, once the knack is acquired, with this slide-speculum to look directly into the larynx (Fig. 2). We see the glottic chink enlarge and diminish in rhythm with the respiratory movement. It is a simple matter, once the glottis is exposed, to insert the bronchoscope through this glottic chink, after which it is not difficult, once the knack is

acquired, to explore the subdivisions of the bronchi with the bronchoscope, the slide-speculum being separated and removed. The insertion of the œsophagoscope does not require the slide-speculum. The insertion may be accomplished by the sense of touch, feeling for the right pyriform sinus with the distal end of the tube, the instrument being pointed, as a whole, like a billiard cue (Fig. 3), or it may be guided by the eye, which is educated to find the sinus by inspection. The chief difficulty encountered by the beginner is in passing the cricoid cartilage. This is a very simple and easy performance to one trained in the work, provided the head is held correctly in the Boyce position, by which the head is raised and the cervical portion of the vertebral column is straightened. For all conditions where the presence of a disease or a foreign body in the *introitus œsophageus* is suspected it is preferable to insert the œsophagoscope by sight, lest the object of the search may be overridden. Whichever method of introduction is used, it is imperative that all further introduction of the œsophagoscope be under the guidance of the eye, which makes the procedure absolutely safe. Varicosities, thin-bedded ulcers, malignant erosions, and other lesions may be touched gently or not at all. Herein lies one radical difference between the old blind methods with the flexible bougie, which in one instance, to my knowledge, perforated into the mediastinum through a cancer of the œsophageal wall. From the cervical œsophagus to the stomach is simply a question of following up, with the œsophagoscope or gastroscope, the lumen of the œsophagus as it opens up ahead of the tube-mouth. At the diaphragm, and rarely at the cardia, it takes a moment to find the lumen. It was at the diaphragm that Mikulicz, twenty-eight years ago, encountered such rigid obstruction that he thought the instrument had struck the vertebral column. There is normally a slight dilatation of the œsophagus above the diaphragm, so that a rigid instrument passed blindly strays from the opening, which in the ocularly-guided, though rigid, instrument of to-day is readily found opening up ahead. The diaphragm passed, the gastroscope glides on readily into the stomach, which is recognized by the wrinkled folded mucosa and by the color, which is red when food is present. In the absence of food, it is pink. Ether-laden mucus does not redden the mucosa as food does.

Anæsthesia.—For direct laryngoscopy for diagnosis no anæsthetic, local or general, is necessary; for the removal of a specimen, however,

it is usually advisable to apply an 8 per cent. solution of cocaine in adults. In children cocaine is very dangerous, and no anæsthetic, general or local, is needed. In bronchoscopy for difficult foreign body cases, such as the closure of open safety-pins before removal, general anæsthesia may be occasionally necessary. If there is partial stenosis, general anæsthesia is not to be thought of, unless a tracheotomy has been done; for as soon as unconsciousness approaches and the aid of the accessory respiratory muscles is lost, respiration ceases, and it cannot be started again unless a rapid tracheotomy be done. For bronchoscopy for diagnosis a little cocaine locally quiets the cough reflex sufficiently in adults. In children it is unnecessary and unsafe. For the extraction of bronchially-lodged foreign bodies a

FIG. 4.



Dosimetric anæsthetizing attachment for the bronchoscope. Devised by Dr. T. Drysdale Buchanan. The small branch tube ends in the lumen of the bronchoscope, and not in an auxiliary canal.

general anæsthetic is occasionally required. It may be started by the open method and continued, after the introduction of the tube, by the method suggested to me by Dr. T. Drysdale Buchanan (Fig. 4), using chloroform or ether, as preferred. For œsophagoscopy in children no anæsthetic, general or local, is needed, either for diagnosis, treatment, or the extraction of foreign bodies, except in those extremely excitable children who are not readily controllable. For both children and adults, in cases where it is a question between spasmodic and organic stricture, the relaxation of general anæsthesia is necessary. The diagnosis of cardiospasm is rendered easy and positive by the disappearance of the spasm under anæsthesia. For gastroscopy, the full relaxation of general anæsthesia is required in

order to render the diaphragm limp, so that it may be readily dragged about without hindrance to the tube. Ether is best, adding a little chloroform occasionally as needed for relaxation, after the patient is safeguarded by the stimulant effects of the ether.

Dangers.—Practically none in skilled hands. Training under a competent master is necessary, and, in the hands of the well-trained, gentleness is essential to safety. Anæsthesia introduces an element of danger to a much greater extent than in other procedures, and is to be avoided wherever possible—and avoidance is almost always possible.

The following cases have occurred in my practice at different times and at different hospitals. They are grouped here as illustrative of the various phases of the subject.

CASE 1.—John T., aged 24 years. Regurgitation after all attempts to swallow since swallowing a bone while eating sauerkraut a few days before admission to South Side Hospital. Referred by Dr. Boyce. Radiograph by Dr. Eyman showed a large shadow high in the thoracic œsophagus. Swallowing of a bismuth capsule for assistance in locating the shadow and also for therapeusis was a valuable suggestion by Dr. Boyce. Œsophagoscopy, under ether, bone (Fig. 5) seized and removed in a few minutes. Uneventful recovery. *Remarks:* The enormous size of this portion of one of the vertebræ of the hog placed it in the class for which external œsophagotomy is usually advised. The author has demonstrated that any foreign body of whatever size or sharpness of surface points, if it can get down in the œsophagus, can be brought up the same way safely. Full ether anæsthesia to prevent clamping of the foreign body by reflex contraction of the œsophageal musculature renders the operation safe. External œsophagotomy is an operation of exceedingly high mortality.

CASE 2.—Ruth S., aged 4 years, "swallowed" a gourd seed. Stools were watched, and a gourd seed was recovered. Severe purulent bronchitis with whistling râles all over left lower lobe aroused suspicion of a foreign body. Bronchoscopy at Eye and Ear Hospital. Gourd seed removed. Uneventful recovery. *Remarks:* Evidently there were two seeds which had escaped down the throat, one going into the œsophagus and the other into the trachea. Radiography being useless, bronchoscopy afforded the only means of determining whether a foreign body was in the lower air-passages or not, and bronchoscopy afforded the only means for quick and safe removal.

CASE 3.—Umberto S., aged 5 months. Choked on a string of "Job's tears," one of which escaped down the throat. Digital attempt by an emergency physician pushed foreign body downward. Dyspnœa, cyanosis, worse when recumbent, cough. Râles all over left lung. Left thoracic expansion much more marked than right. Radiograph negative. Bronchoscopy at Eye and Ear Hospital. Removal of "Job's tear" (seed of *Coix lachrima Jobi*), which fitted as tightly in the right bronchus as a cork in a bottle (Fig. 6). Removal of the foreign body "uncorked" a collection of pus in right bronchus which would have soon proved fatal. Uneventful recovery. *Remarks:* An infant has been

regarded as a difficult case for bronchoscopy, but perfected technic has enabled the author to remove foreign bodies in all infantile cases by bronchoscopy through the mouth, and he has never yet been obliged to do a tracheotomy for bronchoscopy. Rarely has any anæsthetic, general or local, been necessary. This is a second case of "Job's tear" in the bronchus in the author's practice, which would indicate that this fetich is in common use among foreigners to charm away the illnesses of childhood.

Case 4.—Infant M., aged 10 months, had a croupy cry, ashy complexion, prostration, temperature 102° F., pulse 130, and respiration 32. Antitoxin had been given without benefit. Attempts at mirror examination of the larynx had failed, as they always do in small children. Direct inspection with the slide-speculum at the Eye and Ear Hospital promptly ruled out diphtheria and revealed an acute laryngotracheitis. There was total absence of the cough-reflex. Clinical diagnosis—influenzal laryngotracheitis. Smears made from swabs passed down into the trachea showed the case to be one of influenzal tracheobronchitis. *Remarks:* The diagnosis from smears passed into the trachea is a matter of very minor importance compared to the point here illustrated that the method of direct laryngoscopy first devised by Kirstein, made practical by Killian, and since modified by others, enables as prompt and satisfactory an inspection of the larynx as can be obtained of the fauces by the use of the tongue depressor. There is to-day no occasion to guess at the reason for a croupy cry, a croupy cough, or a laryngeal dyspnœa. It is simply a matter of a moment to look and see, without any anæsthesia, general or local.

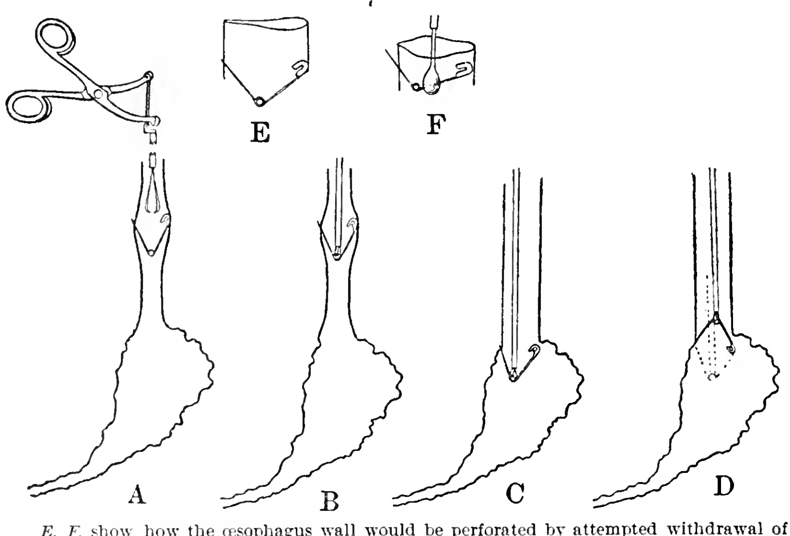
Case 5.—A child of 6 years was admitted to the Presbyterian Hospital with the history that five days before she had choked and vomited at dinner. It was supposed that a piece of bone had lodged in her throat. Two physicians had worked for two hours with instruments on the anæsthetized patient, but had failed to remove any foreign body. The child's temperature was 101° F., pulse 128, and respiration 28. Appearance septic, breath foul, and swallowing difficult and very painful. Inspection of the pharynx showed a putrid gangrenous mass of mutilated tissues, too severely lacerated to justify examination. Discoloration and swelling externally simulated a "Ludwig's angina." Septic symptoms steadily increased and the child died five days after admission. Post-mortem showed an abscess in left hypopharynx, gangrenous œsophagitis, and bodies of three vertebræ denuded, two partially denuded, the lowest damaged being the sixth. Macroscopically and microscopically, it was clear that the condition was due to recent trauma, and not to tuberculosis. No foreign body was found. *Remarks:* This case gave a beautiful example of acute œsophagitis from blind efforts at removal of a foreign body. Whether a foreign body had been present or not is not the point. It is one of the sad duties of the œsophagoscopist to see little children brought in dying or seriously ill from rough, unjustifiable, brutal attempts to remove a foreign body by such relics of obsolete surgery as the Graefe basket, the coin catcher, Bond's forceps, bristle probangs, etc. It may be thought that the bristle probang should not be included here. Possibly its use may not be very dangerous in the adult, but in infants it is, to my certain knowledge, often fatal. The only safe method is to proceed only under the guidance of the eye, as in modern œsophagoscopy.

Case 6.—Boy, aged 5 years, aspirated an 8-penny nail, one week before admission. Temperature 103° F., respiration 38, and pulse 130. Physical signs

of septic pneumonia. Radiograph (Fig. 7) showed the nail lying in right main bronchus. The nail (Fig. 8) was removed at the Eye and Ear Hospital in a few minutes by bronchoscopy and the child slowly, but completely, recovered from the septic pneumonia.

Case 7.—Man, aged 21, had been unable to swallow anything, even saliva, since a large piece of lamb had lodged in his throat the day previous to admission. Attempts had been made by physicians in his home town to force the meat down into his stomach with bougies, probangs, and improvised instruments. It required about fifteen minutes with the œsophagoscope and the mechanical spoon to remove the mass of putrid meat shown in Fig. 9. The recovery was uneventful. *Remarks:* While the blind attempts at removal by pushing the œsopha-

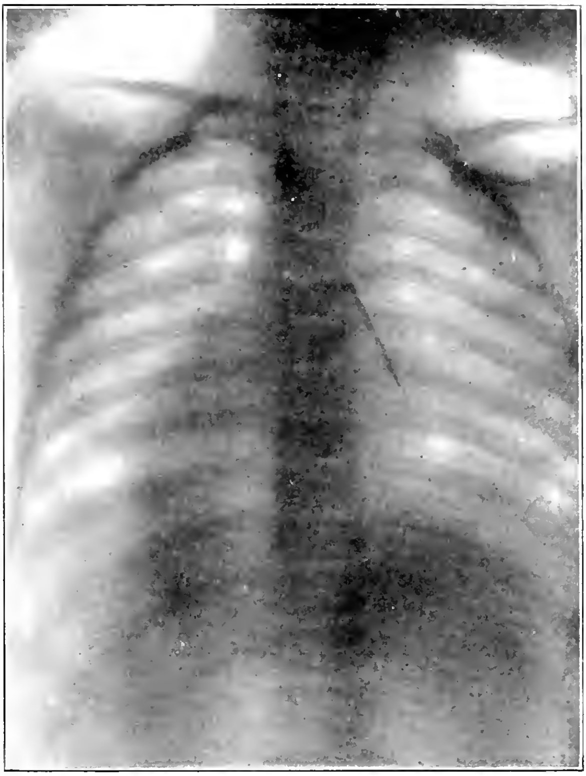
Fig. 10.



E, F, show how the œsophagus wall would be perforated by attempted withdrawal of an opened safety pin lodged point upward in the œsophagus. *A, B, C, D,* show successive stages of a safe method of removal by passing the pin into the stomach, turning and removing by special forceps and œsophagoscope. The entire procedure is under guidance of the eye.

geally lodged foreign body downward did no serious damage in this case, there are many similar cases which have ended in death from perforation with instruments whose distal ends are out of sight and beyond control in all blind methods. In such cases the pleural cavities are found to contain putrid fluid of fecal odor from saprophytic and other bacterial processes. In other cases, severe ptomaine poisoning has resulted from the putrid meat pushed downward into the stomach, where this has been done, though attempts at pushing downward are rarely successful. Anyone who has ever experienced the intolerably foul odor would not want to push the putrid mass downward. The only safe way is to remove it, as in this case, quickly and safely under guidance of the eye. Open safety pins when lodged point downward in the trachea or œsophagus present a relatively easy task for the œsophagoscopist; but when lodged point upward, great care and skill are required safely to remove them. A number of ingenious pin-closers have been devised. One method, devised by the author, shown in Fig. 10, was

FIG. 7.



Radiograph by Dr. George C. Johnston showing 8-penny nail (see Fig. 8) in right main bronchus of a boy aged 5 years. Removed bloodlessly through the mouth by bronchoscopy. (Case 6.)

FIG. 8.

FIG. 9.

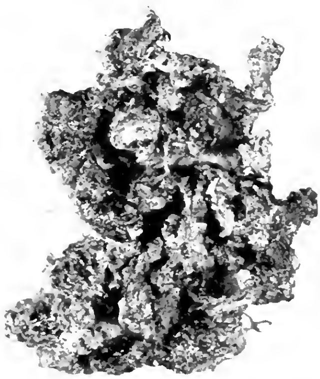
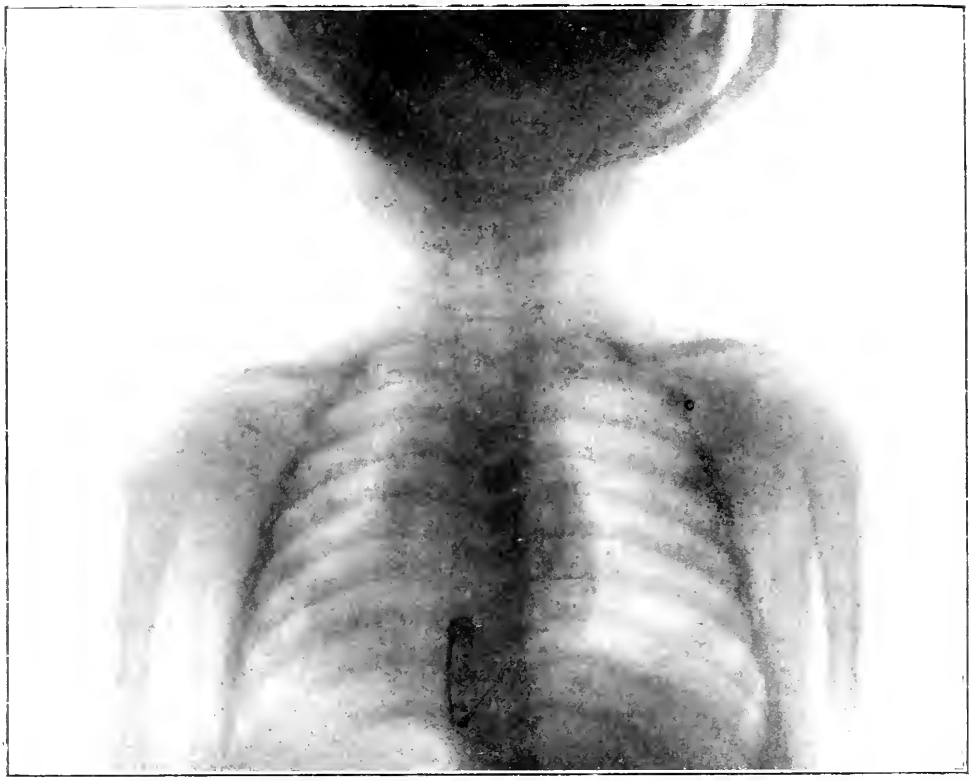


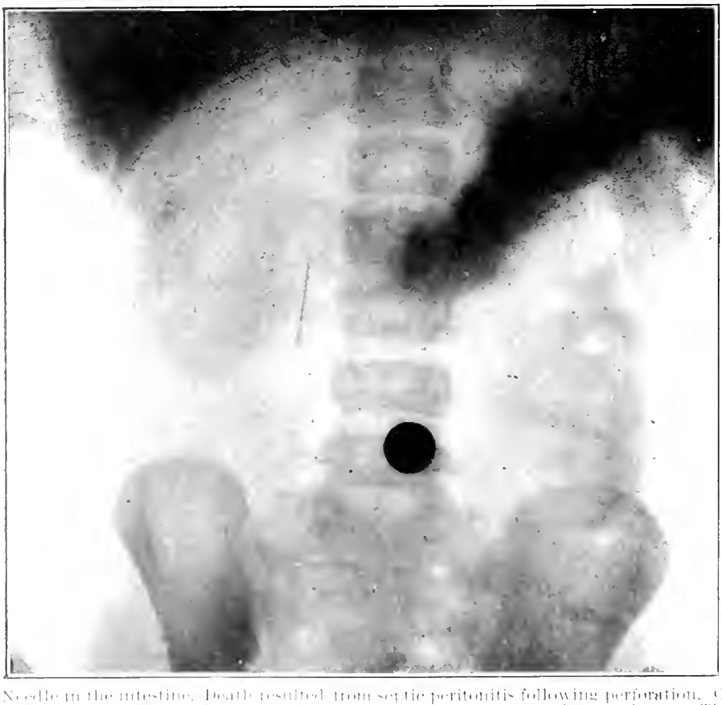
Fig. 8.—Nail, shown in radiograph Fig. 7, removed bloodlessly through the mouth by bronchoscopy. (Case 6.)
Fig. 9.—Mass of putrid meat removed from the œsophagus by œsophagoscopy. (Case 7.)

FIG. 11.



Radiograph by Dr. George C. Johnston showing an open safety pin (Fig. 12) in the œsophagus of a child aged two years. The pin was removed by the method shown schematically in Fig. 10.

FIG. 13.

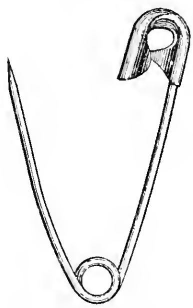


Needle in the intestine. Death resulted from septic peritonitis following perforation. Œsophagoscopy was opposed by the family physician when the needle was in the œsophagus. The position of the stomach is shown by the bismuth shadow.

used on the case illustrated in Fig. 11, and in four other cases, with perfect success. Open safety pins in the trachea are much more rare than in the œsophagus. Dr. G. Hudson Makuen reports one case in which by a very ingenious method he removed a safety pin from the trachea of a girl, aged 13 years.

Foreign bodies can be removed from the stomach by gastroscopy, but as a rule, when foreign bodies reach the stomach, there is little danger. But more patients have been killed by blind attempts to push a foreign body down into the stomach than will ever be known. Foreign bodies lodged in the œsophagus, trachea, or bronchi are almost invariably fatal if left to themselves. Their removal by œsophagoscopy or bronchoscopy, as the case may be, is quickly and safely done by those skilled in the work.

FIG. 12.



Safety pin (actual size) removed through the mouth by œsophagoscopy from œsophagus of a child of two years. Passed into stomach, turned and removed as shown in Fig. 10.

CASE 8.—A man of 40 years had the usual symptoms of chronic gastritis for many years, with occasional intervals of complete absence of symptoms, and other intervals of symptoms pointing quite certainly to gastric ulcer. He was referred to the author for gastroscopy. The gastroscope revealed an advanced carcinoma of the lesser curvature which was so extensive as to be inoperable. About three months later involvement of the œsophagus prevented swallowing; gastrostomy was done for feeding, and death eventually resulted from exhaustion. *Remarks:* Of course, it is possible that the carcinoma had existed for years; but had gastroscopy been done sooner the early cancerous stage, or even the precancerous stage, of the lesion might have been discovered in time for an abdominal operation to have cured the patient. The patient had always refused "to be cut open to see what was the matter," which was his idea of an exploratory operation; but he unhesitatingly consented to a gastroscopy the first time it was proposed.

OBSERVATIONS ON SURGERY OF THE KIDNEY

BY HUBERT A. ROYSTER, A.B., M.D.
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MUCH progress in renal surgery has been made within the past several years. At the present time there is not a great deal of new or interesting matter on the purely operative side. The advancement has been largely through improvements in methods of examination, which have strengthened both our diagnostic and prognostic knowledge and, therefore, laid the foundation for safer and saner operative treatment.

Chief among these improved methods is the use of the so-called instruments of precision—the cystoscope, the skiagraph, and the functional tests. Their value is unquestionable. We sometimes wonder how we ever got along without them. Yet they must be of service for the most part in enabling us to confirm or reject clinical findings. Take, for example, the X-ray plate. All of us, no doubt, have had the experience of removing renal calculi which did not show in the negative and of cutting for an evident stone without discovering it. Such a contrariety does not often occur, but this occasional source of error must be recognized and allowed for. The cystoscope is perhaps the most reliable and widely useful instrument of all, for by its aid can be determined whether one or both kidneys are diseased, and, in connection with various chemical agents, the functionating capacity of each organ may be ascertained. A great deal of good surgery on the kidney has been done without the employment of these more or less accurate diagnostic means; but with them much bad surgery has doubtless been prevented and a larger field opened up for better surgery. Clinical data, however, are of the utmost consequence and can never be relegated to the background. There is still room for the careful history, the thorough physical exploration, and the calm human judgment. And whenever the instruments of precision fail to conform to the clinical picture, preference should invariably be given to the clinical picture.

Undoubtedly the most frequent surgical affections of the kidney

FIG. 1.

Kidney containing large stone.

Fig. 3.

Sarcoma of the kidney.

are stone and tuberculosis. Next to these come displacements, septic infections, tumors, and injuries. It is generally agreed, I think, that, with the exception of certain cases of displaced kidney, the treatment of these disorders is always operative—and the earlier the better. Yet there are certain mooted questions which continually present themselves in the management of such cases, and a recounting of my personal experience may not be out of place.

Stone.—Granting that the existence of a renal calculus is sufficient reason for its removal, the problem resolves itself, first, into demonstrating its presence, and, second, getting it out in the easiest possible way. The usual renal colics, followed by the discharge of urine containing blood and perhaps pus, with tenderness in the loin, may or may not be typically present. Often there is merely a dull lumbar ache, constant or intermittent, with no pyuria and only occasional microscopic hæmaturia. Let us get away from depending upon "cardinal symptoms." They are sometimes actually terminal events. Just as in gall-bladder disease it is no longer justifiable to wait for jaundice before making a diagnosis and advising operation, so, in a suspected renal calculus, it would be desirable to locate the stone and extirpate it before the kidney is damaged or the patient's health ruined by infection and drug addiction. Out of six patients that came to me within a period of two years, four were victims of the morphine habit, one of them beyond recall. In all of these cases symptoms had existed for years and each one had practically made his own diagnosis.

Pain is dependent more upon the location of the stone than upon its shape or size. If it is situated low down in the renal pelvis where it may easily engage in the lumen of the ureter, more suffering is produced than if it were in the body of the kidney. Then, again, a very large calculus which completely destroys the organ may give rise to no acute pain. Such a condition was exhibited by a recent case, in which a four-ounce stone was removed along with the shell of a kidney, and in which the patient, though septic, anæmic, and greatly emaciated, experienced only a dragging sensation in her side (Fig. 1). Her nephritic colics occurred seventeen years before, and she said that her doctor had cured her of these attacks. What happened was this: the calculus, after doing all the destruction possible, grew so large that it ceased to be a source of painful irritation, and,

instead of a stone in the kidney, it was an instance of the remains of a kidney around a stone. If there is anything characteristic of the lumbar pain of renal calculus it is its tendency to become worse on exertion and to be elicited by pressure, especially over the twelfth rib posteriorly.

Urinalysis, cystoscopic examination, and the making of an X-ray plate complete the evidence. Other facts which may be mentioned are that stones are bilateral in 50 per cent. of cases; that they are found in males much more often than in females, the proportion being about 95 to 5; that heredity plays a large part in their occurrence. It is my impression—and I find it coincides with the experience of some other surgeons—that, except in children (where the reverse holds good), we are now seeing more stones in the kidney than in the bladder. This observation, if true, would seem to show that better diagnostic methods and earlier interference are in vogue.

The only questions at issue in the operative technic are the incisions for exposure of the kidney and the choice of sites for extracting the calculus. As between the lumbar and the abdominal incisions, the former is necessarily the one which will be most commonly practised in all kidney operations, unless it be for the removal of large renal tumors, when the anterior approach only will suffice. The abdominal route, however, may yet afford a wider opportunity of usefulness than it seems at present to have. The oblique loin incision commends itself to the largest number of operators. Muscle separation will be as available here as it is over the appendix in front, and the helpful point to remember is that this separation is best made in the line of cleavage between the anterior and posterior muscles—that is, between the abdominal and lumbar sets—rather than by ploughing down directly through the thick muscles of the loin. The kidney can be reached and delivered with ease through this incision.

Some writers have stated that there is little danger of wounding the pleura when the incision is carried high up on the twelfth rib. W. J. Mayo has just mentioned opening the pleural cavity 13 times in 256 kidney operations (but without harm), and, to avoid this, suggests an incision at first longitudinally along the erector spinæ from a point above the last rib, and extending downward for two to three inches, and then being prolonged into the ordinary oblique

FIG. 2

Tuberculous kidney, with only a small portion of normal tissue, which is seen in the lower portion of the illustration, to the right and left.

incision below. The matter of whether to cut through the parenchyma or the pelvis for the stone has apparently been settled for both sides in the controversy, when experience showed that it makes little difference which method is employed. The point is to make the incision into the kidney over the nearest area at which the calculus can be most conveniently delivered. It is not always very easy to find the calculus even when the kidney is exposed. Palpation carefully done may be all that is needed. Needling is now unreservedly condemned, though it may be made to perform admirable service; but I should certainly refuse to execute the "postmortem section" until every other means for discovering the stone was exhausted. A kidney split open, either in this way or by injury, may be tied back together, as lately proposed by some one, by winding catgut strands around it, after the manner of wrapping up a bundle, in lieu of putting stitches through the organ itself. It is rarely necessary to remove the kidney for stone. Now and then, in the presence of a pyonephrosis, nephrotomy may first be indicated, followed later by a nephrolithotomy or possibly a nephrectomy.

Tuberculosis.—If there is one condition which is worthy the study of every practitioner of medicine, it is tuberculosis of the kidney. That this affection, as a rule, is hæmatogenous in origin and unilateral in distribution; that in its clinical course it is nearly always first recognized by bladder symptoms; that it is not incompatible with the appearance and feeling of good health; that it is amenable to surgical treatment even at times in the advanced stages—all these facts are well known, but need frequent repetition and emphasis. Very early recognition of the disease may be difficult or impossible because there may be nothing at all to indicate its presence. Usually vesical disturbance is the primary complaint—frequent micturition with tenesmus and occasional bloody urine. Renal tuberculosis should be sought for in any case of cystitis that cannot be proved to be due to gonorrhœal or other infection or to calculus. A constantly low blood-pressure is said to be a reliable diagnostic aid, and thickening of the lower end of the ureter practically pathognomonic. This latter condition can easily be demonstrated in women, who are apparently more subject to the disease than men. I have never seen a case in the male; but Braasch notes, in 203 patients, that 61 per cent. were men. Tubercle bacilli in the urine are absolutely

positive proof of the diagnosis, but their absence from many consecutive specimens should neither cause delay nor count against a suspicion founded on clinical data. The involved kidney may be enlarged and tender.

Removal of the diseased organ is the reasonable treatment for kidney tuberculosis—early if we can, late if we must. For the larger number of cases will completely recover. Even extensive tuberculosis of the bladder is no contra-indication, since this generally clears up after the nephrectomy. The operation is not without special risk owing to possible inroads on the patient's general condition, from long-drawn-out infection and suffering, and to the frequent extension of the disease beyond the kidney, involving the renal vessels. One of my cases died twelve hours after operation as a result of profuse primary hemorrhage due to tearing the friable pedicle, when the kidney was lifted out. The vessels were finally secured, but not until the patient, a weak, anæmic woman, was irretrievably exsanguinated. But not all cases are of this type. The photograph (Fig. 2) here presented shows a tuberculous kidney from a woman who looked the picture of health and weighed nearly two hundred pounds.

Displacements.—Forms of displacement of the kidney, heretofore classified under different names, are now all described by the term "movable kidney." The condition may come from a congenital predisposition, may be due to trauma, or may result from absorption of kidney fat—in all of which cases it shows a resemblance to hernia. It may be a part of a general ptosis, abdominal and pelvic. It is more common in women, at least ten to one. Symptoms vary from none at all (the loose kidney being discovered accidentally), or very mild gastric disturbances with nervous phenomena, up to pronounced neurasthenia on the one hand, or to severe, definite attacks of abdominal pain on the other. Very little trouble is had in detecting a mobile kidney on examination. More perplexing is the question of deciding what to do with it or what not to do with it. Safe working rules are these: if the nephroptosis is stumbled on unawares, let it alone: if there are digestive and nervous symptoms, with or without pain, the application of an abdominal support or a specially-fitted corset may give relief—not so much that the kidney is pushed into place by these means, but that its excursions are limited and other organs and structures are not pressed upon; if there are distinct

Dietl's crises, the operation of nephropexy is justifiable and will, in well-selected instances, yield good results.

When the prolapsed kidney is associated with widespread visceroptosis, two alternatives loom up: either doing nothing or doing a very great deal—that is, attending to all or none. In the light of our present-day performances in abdominal ptoses, it might seem feasible to resect bowel, anchor viscera, and fix kidneys, all at one sitting; but this programme is hardly to be recommended in this class of patients, and the problem simmers down to judging which group of displaced organs is primarily or chiefly at fault, and directing the treatment toward that. At different times the entire pathology could be corrected by operative effort, or recourse to abdominal support might finally suffice.

My own conviction is that only a small percentage of movable kidneys need a surgical operation. On an average, I see about thirty or forty of them every year and I operate on about two or three. Undoubtedly some of those who are declined by me fall into the hands of other surgeons who operate on them successfully; but I have been able to keep up with a fair proportion of the patients, and most of them are satisfactorily relieved without a nephropexy. I do not mean to say that the operation is useless or unnecessary; it has a clear field, as I have tried to point out. But its limitations must be known and its indications must be plain. No procedure yet devised ever restores the misplaced kidney to its primal nest. The most we can do is to keep it fastened near the posterior abdominal frame as high up as possible. The Edebohls technic has always appealed to me as being surgically sound, and I have usually followed it, with occasional modifications.

Septic Infections.—The colon bacillus, the gonococcus, and the ordinary pus-forming organisms may, singly or together, invade the kidney and infect it. This infection may be primary; or it may be secondary to some other condition like stone. Pyelitis is the first evidence of trouble, and its degree will vary from a very mild form to a final and extensive involvement of the whole organ (pyelonephritis). Medical treatment and local measures are first to be employed, with the hope of preventing destructive changes. When such changes have taken place, surgical aid must be invoked for the purpose of evacuating pus (pyonephrosis) or fluid (hydro-

nephrosis) or of draining the pelvis of the kidney in an otherwise incurable inflammation. The operative results in some of these cases are remarkably good, even though the effort be conservative. Judgment will always be demanded to determine quickly whether to incise and drain, or whether to remove the kidney. The tendency will properly be to save whatever is possible at the time and to take out the organ later, if necessary. But any one who has had to do many secondary nephrectomies will hesitate to recommend them as routinely advisable.

Tumors.—The kidney is rarely the seat of new growths, and when they do occur by far the larger majority are malignant. Benign growths are the simple cysts, hydatid cysts, adenomata, lipomata, etc. The sarcomata are found largely in children and differ in structure from those found in adults. They are usually fatal and the operative mortality itself is high. Those which I have observed in children, several in number, were invariably rhabdo-myo-sarcomata. The one adult upon whom I operated was at an advanced stage and lived less than a year (Fig. 3). This patient had three attacks of pain, beginning always in the right loin, the first in December, 1910, and the last in March, 1911. He had rapidly lost flesh and had bloody urine. There was a large and somewhat tender mass in the right lumbar and hypochondriac regions. Nephrectomy was performed April 2, 1911, through a long anterior incision. The tumor extended from diaphragm to pelvic line and was adherent everywhere. The kidney showed cystic degeneration at the upper pole and the solid malignant tumor at the lower, with a few streaks of normal parenchyma between.

Carcinoma of the kidney is in my experience much less common, as I remember to have had but one case. Its origin is, of course, from the renal epithelium, and it infiltrates rapidly with early involvement of the surrounding structures.

A hypernephroma is a tumor due (as has been generally believed) to invasion of the kidney by wandering tissue from the adrenal glands. This view has been combated by two or three observers, and the most recent opinion is that "the so-called hypernephromata are best interpreted by the hypothesis that they are the result of proliferation of islets of nephrogenic tissue (mesoblast) which have never become connected with the renal tubules (derived from the Wolffian

FIG. 4

Hypernephroma of the kidney.

duct)." (Wilson.) There are two significant features manifested by these growths: they are malignant in character and they tend to form metastases in the long bones. Much might be here set down about the pathology of hypernephromata, but, in the unsettled state of our knowledge of them even in the minds of admitted experts, it would be of no practical advantage to rehearse the well-known descriptions. One case of hypernephroma has fallen to my lot, that of a woman of 54 years, upon whom I did a left-sided nephrectomy on June 19, 1911, through an anterior incision. The lower pole of the kidney was densely adherent, and the pedicle was ligated with difficulty. The specimen (Fig. 4) is that of a very large kidney, its lower two-thirds practically destroyed. The upper portion is normal. Characteristic yellowish areas and the distorted pelvis proved it a typical hypernephroma. The patient is still living, but is now (May, 1912) showing cachexia and other evidences of recurrence.

It is a very great misfortune that kidney tumors, which are practically all malignant, are seldom found until they are so large as to preclude the chance of final recovery, except in a small number of cases. For the most part the growths are symptomless. Hæmaturia and pain are the signboards, but their pointings may not be distinctive and differentiation may be difficult. So far as I have seen, the hæmaturia is not closely associated with the pain, and the pain is not a colic, but a constant ache with acute exacerbations, accompanied by a "tight feeling." When the enlargement of the kidney is detected (and this is the only absolute evidence of renal tumor), we have not yet determined the nature of the growth, beyond the presumption that it is malignant. Fortunately, this finer separation is not essential, as the indication is the same. Nephrectomy is called for, provided the patient has not cachexia or metastases, and the kidney is free enough to permit of its safe removal. The size and position of the tumor will be the guides in deciding upon the lumbar or the anterior route. The mortality rate in these operations is being steadily lowered, and the percentage of permanent cures is increasing.

Injuries.—Wounds of the kidney occur as the result, indirectly, of blows or falls, giving rise to contusion, laceration, or rupture; directly, from weapons, producing incisions, punctures, or damage from bullets. Gunshot injuries are very much more common than the others. The only case of the first class which came under my

care was that of a boy, who received a subparietal injury to his left kidney caused by a blow from the knee of a companion with whom he was scuffling. After a tedious convalescence he recovered without operative intervention. In the presence of advancing symptoms, and particularly of an increasing enlargement in the loin, it is better to make an exploratory lumbar incision before the patient becomes too handicapped. Gunshot wounds of the kidney are nearly always complicated by injuries to other organs, and their management depends a good deal upon this fact. My hospital services have furnished several such cases during the past few years. Our rule has been to open the abdominal cavity in front first, even when the wound of entrance was behind, and whether or not injury was found in the peritoneal viscera, the kidney could be dealt with as seemed best. It is a matter of moment to decide what to do with the kidney. In the case of uncontrollable hemorrhage or of liberal damage to the organ, it might be necessary to remove it; in other events it would be right merely to sew up lacerations and put in a drain. At every turn there is need for sound surgical judgment, which is built upon experience and common sense.

Obstetrics

PUERPERAL INFECTION

BY WM. EDGAR DARNALL, A.M., M.D.

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It is probable that puerperal infection has occurred as long as children have been born. Passages in the works of Hippocrates, Galen, Avicenna, and others of the ancients clearly have reference to this disease. The old term "puerperal fever" is vague and misleading and for many reasons may be discarded. Under the general head of puerperal infection are now included all the various morbid conditions which result from the entrance, during labor or the puerperium, of infective microörganisms into the female generative tract.

While great advances have been made in recent years in our knowledge of puerperal infection and its treatment, there are yet many problems which are not entirely settled and about which there is difference of opinion among authorities of equal rank. Problems are presented to the surgeon in the consideration of this condition which require that he must know when to withhold the knife as well as when to employ it for the relief of the patient. The mere fact that a woman has febrile symptoms associated with the puerperium should not lead to an invariable diagnosis of sepsis; there are many other causes which may be responsible for this condition, as malaria, typhoid, influenza, intestinal toxæmia, etc., and an increase in temperature and pulse-rate may occur without any apparent cause, as in the following case:

A woman, the day after her accouchement, which was conducted in the most careful way and after the most approved methods, developed a severe chill. This was followed by a fluctuating temperature running between 102° F. and 105° F., and a pulse rapidly rising to 135 and higher, one day reaching 190. This condition of affairs lasted about a week, during which time the patient looked well and felt as well as could be. The lochia was normal; involution was good. There

was no abdominal tenderness or tenderness in the pelvis about the uterus. No retained products were present, and it was demonstrated that there was no infection, by various examinations, nor were the symptoms those of embolism. In about a week's time all symptoms subsided and the rest of the puerperium was normal. We therefore concluded that they had been due to some vasomotor disturbance, as there had been no occasion for nervous excitement and the patient was just the opposite of the usual hysteric type.

The Puerperium.—It has come to be recognized that there is considerable difficulty in diagnosing the cause of fever in the recent mother, and that many procedures which have heretofore been widely employed in the treatment of puerperal fever are dangerous or of indefinite value. The involution of the uterus is interfered with in a most decided way by the existence of any degree of fever, and especially by the presence of any retained products of conception, such as portions of membrane, placental tissue, or blood coagula.

Small coagula almost invariably form in the upper part of the vagina a few hours after delivery, the clot frequently extending up into the cervical canal. Freshly-formed clot appears to possess some bactericidal power, but this is speedily lost. After forty-eight hours the clot is not only nonbactericidal but, on the other hand, a most perfect medium for the growth of organisms. In the first few days following delivery there are present many types of bacteria in the upper part of the vagina. Mansfeld and Lea, in the study of a series of cases, demonstrated the presence of streptococci, staphylococci, pseudodiphtheria bacilli, and those of the colon group. Now with a blood-clot extending from the upper vagina up into the cervix these organisms grow rapidly through it up into the uterine cavity. It therefore follows that if the uterus is improperly drained of its lochial discharges sepsis may easily take place.

In order to accomplish more perfect drainage some German authorities have advocated early rising of puerperal patients, even going so far in some cases as to have them out of bed the second and third days. Von Alvensleben, Rosenfeld, and Mullerheim claim that puerperal patients by so doing are much less likely to have displacements, and that drainage of the lochia is encouraged. It is scarcely fair, however, to compare our American women of the better class to the German peasantry in point of physical strength.

Conclusions drawn from hospital statistics of the latter class cannot serve as a criterion for us in putting the patient on her feet.

Reuben Peterson thinks that subinvolution, in the majority of cases, is not a matter so much of early rising or position of the patient as it is of infection. If there is no infection, involution proceeds normally. If there be sepsis, involution will be delayed. Most American obstetricians, including Peterson, Hirst, DeLee, Franklin S. Newell, and Webster, keep their patients in bed from nine to eleven days, but do not limit their movements while in bed. J. Whitridge Williams says: "I have not yet been able to convince myself of the correctness of the advocates of early rising, and I believe it will soon prove a dangerous and useless fad."

Frequency, Mortality, and Morbidity.—Broadhead claims that the mortality from puerperal fever in hospitals is gradually decreasing, but in private practice the mortality as well as the morbidity is not much better than it was several years ago. The most striking evidence of the value of modern aseptic and antiseptic methods is afforded by a statement of the mortality statistics published by some of the maternity hospitals in various parts of the world. In the York Road Hospital 8373 deliveries occurred in sixteen years without a death from infection. At the Rotunda Hospital in Dublin out of 2060 patients delivered three deaths occurred. At the Clinique Baudeloque in Paris in 15,000 deliveries the death rate from infection was .09 per cent. At Johns Hopkins Hospital the mortality is 1.1 per cent., while von Herff at Basle shows 6000 cases without a death. Although this list could be extended indefinitely, it is enough to show the results under modern treatment.

Compare now the death rate of cases in private practice, which is nearly as large as it ever was. Some figures published by Kröhne are very instructive. In an analysis of 1,850,000 deliveries in Prussia there were 7893 cases of infection, and of these 2826 died, the relation of mortality to morbidity thus being 35 per cent. Polak says: "In my experience the high mortality, and especially the morbidity, in puerperal sepsis is produced by medical men, and is due to the insufficient disinfection of the hands, together with a tendency to undertake operative delivery, often in the absence of any absolute indication, before complete dilatation of the passages

is obtained. Sepsis is not measured by its mortality, but by its morbidity, largely due to the tendency of practitioners to interfere with the endometrium by surgical measures."

The gravity of any outside interference in a delivery cannot be too strongly emphasized. The same scrupulous care and attention to aseptic detail must be exercised as if an abdominal section were to be performed. Carelessness in this regard and the itching desire to do something of an operative nature must be regarded as factors of the greatest importance in maintaining this high puerperal mortality. Lea states that 40 per cent. of fatal cases show that some operative procedure has been attempted by the physician in charge. And yet all the blame is not to be laid at the door of the physician. In foreign countries and among the foreign population of our own large cities perhaps 60 per cent. of the deliveries are attended by midwives, who are usually both ignorant and careless. On the other hand, even where physicians are in attendance, the ignorance and carelessness of the patients themselves are all-potent factors in producing infection. Often the doctor is called at the last moment and finds possibly an ignorant and meddlesome woman in charge of the patient, who may have attempted examinations, given douches, and worked mischief before his arrival. The patient, infected possibly with pediculi, has had no preliminary cleansing. The presence of bedbugs does not help the matter. The bed linen and clothing are dirty, the house often unsanitary, and the conveniences for aseptic measures lacking. After delivery the principles of nursing are neglected by the nurse, who undertakes to do the housework, cook the meals, wash the linen of both mother and child, and handle the evacuations of both without ever a thought of disinfecting her hands when she has to care for the patient. Under such circumstances it is impossible to control the details essential to the puerperal period, and yet if anything goes wrong it is the physician who has to bear the odium and incur all the responsibility. The marvel is in this class of practice that the mortality is as small as it is.

Mode of Entrance of Organisms into Wounds of the Generative Tract.—It would be better to entirely forget the older classifications of sapræmia, septicæmia and pyæmia, which are more or less confusing, and remember that all forms of puerperal fever and infection are attended by certain general symptoms due to the toxic prod-

ucts of bacterial activity, which circulate in the blood and the tissues of the body. Though differing in intensity the symptoms are essentially the same, and are to be attributed to the diffusion of soluble toxins. The severity of the infection and the disturbances of metabolism which follow depend upon the nature and specific toxicity of these products. From the simplest saprophytic infection, with symptoms lasting only a few hours, to the most severe septicæmia or pyæmia, the symptoms are essentially due to toxæmia, and, after all, it is a difference only in degree and virulence of the specific germ or germs.

Pathogenic bacteria may occasionally be introduced into the generative tract during pregnancy, but almost always the infection occurs during labor or in the early days of the puerperium, and results from the direct introduction of the organism. There must be a point of entrance, and this is afforded through wounds or abrasions in the perineum, the vulva, vagina, and the cervix, or defects in the mucous membrane of the uterus through which bacteria of varying virulence pass. These organisms are in a great majority of the cases derived from some external source and are conveyed by the hands of the medical attendant or midwife or instruments, or by unsterile dressings, as was first stated by Semmelweiss. Often bacteria are carried in from the vulva, which has been demonstrated to be teeming with various forms of germ life. A vulvitis, eczema, furunculosis, fistula in ano, ulcerating hemorrhoids, or bartholinitis, as well as urethritis, pyelitis, or cystitis, may be the cause of a violent infection. Organisms from the lower part of the intestinal canal are frequently present on the vulva, particularly if the patient is not cleanly in her habits and if there are lacerations present. Fortunately the organisms under such circumstances are not virulent types. They usually consist of *Bacillus coli communis, Bacillus aërogenes capsulatus,* and *Micrococcus fœtidus* and other putrefactive bacteria.

Clinical experience has shown that in spite of the strictest aseptic precautions and without any vaginal examinations or manipulations a rise of temperature due to an infection is by no means infrequent. In some instances this may arise from pre-existing disease of the appendages, a tumor of the pelvis, or even an appendicular abscess. I am sure I have seen quite a number of in-

fections which have resulted from an old pus-tube which had been lighted up by the process of labor. In several of these cases seen in consultation the attending physician had given a history showing that no examination or manipulation whatever had taken place, birth already being accomplished when he arrived or delivery nearly completed.

Sometimes coitus during the last few days of pregnancy may result in introducing streptococci. Often an ignorant woman will make attempts at self-examination before or after labor and get herself into trouble. Dirty bed linen or the practice among patients of the lower classes of tearing up any old rags or muslin for use as vulval pads is a frequent source of infection. As labor is a dirty job they frequently fish out the worst old coverlet in the house, rotten with the dirt of years, to place underneath the patient to catch her discharges, feeling that at least that cannot be hurt.

DIAGNOSIS

In the diagnosis of puerperal infection it is important that the history of the delivery be investigated, paying especial attention to such factors as frequency of vaginal examination, the use of instruments or manipulations, the character of the third stage of labor, and the existence of lacerations of the perineum, vagina, or cervix. The most severe forms of infection are due to the introduction of organisms from some specific source of wound infection.

Much attention has recently been paid to bacteriological examinations of the lochia collected very carefully from the interior of the uterus in an attempt to determine just which organism might be producing an infection. Too much weight should not be given to the results of such examination, however, inasmuch as it has been demonstrated that streptococci and staphylococci have been found often in women who had no symptoms and whose labor was normal in every respect. Investigators argue, therefore, that we are not justified in classing a case as streptococcus toxæmia just because a few nonvirulent streptococci are found on a cervical smear or uterine culture. The isolation of the offending bacterium, then, is not of decisive value in making an accurate diagnosis, because cases in which streptococci are found in the uterus often get well, while the cases showing sterile cultures may die. Yet when the attending

physician knows what organism is at work it may help him to judge when to be radical and when to be conservative.

The Lochia.—It has been an impression in the past that the suppression of the lochia, or very foul-smelling lochia, was the strongest symptom of infection, but it must be borne in mind that some of the most frightful and virulent forms of streptococcus infection are associated with little or no change in the lochia and there is no abnormal odor. Generally it may be said that the more foul-smelling the lochia present after childbirth the better chance the patient has of recovery from a case of infection, because the lochia associated with putrid odors is most often significant of infection by the less virulent bacteria, such as *Bacillus coli, Bacillus fœtidus,* etc.

The Examination.—The abdominal examination should always form a part of the examination of every case of possible infection, and is of great importance. The size of the uterus must be estimated by careful palpation, for delayed involution is one of the first signs of infection. In the early days of the puerperium some degree of tenderness is frequently observed, and, if there is associated with this an enlargement of the uterus, the presence of retained clots or products must be suspected. If, on the other hand, there is a uterus normal in size and with the complete absence of pain and tenderness the existence of infection is improbable. It must always be borne in mind, however, that some very acute forms of infection may exist with little or no local evidence of infection. Indeed, in pure thrombophlebitis the uterus does often undergo complete involution, and it may be impossible to detect any local inflammatory lesion either in the pelvic peritoneum or the connective tissue.

Examination of the vulva, vagina, and cervix will usually reveal some evidence of infection, but in the subacute forms of the disease arising during the second week this may be slight. In the more severe forms there will be found lacerations covered with a whitish necrotic membrane, and this usually points to an infection with streptococci. In my own experience, however, I have nearly always found a decided tenderness on bimanual examination existing in the perimetritic cellular tissues, and the uterus itself is tender on pressure.

The most significant symptom of pyæmia is undoubtedly the repeated rigors which occur in at least 75 per cent. of the cases. One or more rigors may, however, occur in the acute localized infections, or they may be observed in the onset of a severe septicæmia in the early days of the puerperium. Arnold Lea says, however, that if the puerperium has advanced to the second week and four or five rigors occur the condition may with confidence be diagnosed as a thrombophlebitis.

In some forms of infection it may be advisable to explore the cavity of the uterus to ascertain its condition. If the abdominal examination has shown an organ with delayed involution and there is tenderness, and especially if the lochia is beginning to be foul, this would suggest the retention of blood coagula or products. If an exploration is made it should be carried out with the strictest attention to the details of asepsis, using a sterile glove for the finger. If portions of placenta, membranes, or blood-clot are detected they should be removed. If the cavity of the uterus is so large that every portion of it cannot be reached by the finger, the cervix should be grasped with a tenaculum and a large dull loop curette, or the broad curette of the type used by B. C. Hirst may be gently passed over the uterine wall with just enough pressure to dislodge the clot, membrane, or placenta, and with as little manipulation as possible.

Gastro-Intestinal Intoxication.—It is a well-recognized clinical fact that a rise of temperature during the puerperium is sometimes the result of absorption from the gastro-intestinal tract. During pregnancy there is in many cases a certain amount of paresis of the intestines from the pressure of the gravid uterus. After delivery the sudden diminution of pressure and the relaxation of the abdominal walls are especially favorable to the stagnation of the fecal contents. This is especially true of the large intestine. Pyrexia in these cases usually commences in the first week after delivery. Sometimes the toxæmia is of such an acute variety, and is associated with symptoms such as severe distention of the abdomen, vomiting, coated tongue, rapid pulse, etc., that the onset of peritonitis is suggested. I have observed several instances of this nature where there was a rigor, the sudden accession of high fever, vomiting, etc., when after a most painstaking examination of the pelvic organs

there existed no symptoms of infection or of retained products. As a rule, a prompt purge with calomel followed by salines relieves the condition. If there is much distention and paresis of the bowels continues an enema of glycerine, turpentine, and epsom salts, or an enema of alum one drachm and milk of asafœtida eight ounces will relieve the condition. A thorough and free evacuation of the bowels is usually followed by a rapid fall in the temperature.

On the other hand, if later in the course of a severe infection there occurs an offensive diarrhœa this is to be regarded as a mode of elimination of toxic products, and should not be checked unless it becomes excessive. In the later stages the evacuations may be passed involuntarily. This is an ominous sign, and is indicative of excessive weakness, just as it would be in typhoid fever or any other grave infective process.

TREATMENT

The treatment of wound infections of the generative tract and its varied results and complications is a question of considerable complexity. Much difference of opinion still exists as to the value of the various methods which have been adopted, and many of the questions of treatment are still in an unsettled condition. In the past I have sometimes thought that in our anxiety to be doing something for the patient we have gone too far and done too much. Certainly our ideas have changed in regard to the effectiveness of frequent intra-uterine douchings with antiseptics, frequent curettings, etc. These probably did no good and in many cases did a great deal of harm.

In many of the slight forms of infection there is a tendency to spontaneous recovery in the course of a few days, even if no active measures are instituted. On the other hand, it is extremely difficult to predict the outcome of a severe type of toxæmia or septicæmia, hence the value of any form of treatment must always be difficult to estimate until we may have arrived at some specific treatment by serums that will be sure of a result.

In selecting any active form of treatment it is well to bear in mind the great principle of *non nocere,* as there is much evidence to show that local treatment of an injudicious nature and at a wrong time may result in a most unfavorable influence on the

course of the disease. It is well, therefore, to be more conservative than radical.

The results shown by Mermann in a series of 8700 cases treated by purely expectant methods are interesting. His mortality was only .43 per cent., and this compares quite favorably with the results obtained in other clinics in which other modes of treatment were adopted. Mermann's treatment includes complete isolation of all cases, absolute abstention from all local examinations or manipulations, the maintenance of complete physical and mental rest, and careful attention and supervision of the patient's nutrition, or, in other words, a treatment such as one would institute with a patient suffering from typhoid fever. Many of his patients were of a mild type, the symptoms clearing up within a few days. In thirty cases the symptoms were severe, and death occurred in seven from sepsis. It is a notable fact that no less than twenty-three of the thirty severe cases followed some form of operative manipulation.

For many years it has been almost universally taught that the provision of free drainage and the removal of the decomposing products, such as retained portions of placenta, blood coagula, and membranes, is an essential feature in the treatment of all forms of uterine infections. Recently, however, the conservative attitude of mind has been extended to the treatment of these conditions. Instead of immediate evacuation of the uterus it is now proposed that in the acute stages nothing should be done, in order to avoid the possibility of further extending the infection. It is maintained that it is better to wait for spontaneous recovery or until the acute symptoms have subsided, as forcible attempts at removal may result in the introduction of virulent organisms into the freshly-abraded wounded surfaces. This point of view is at the present time adopted by a large proportion of the German obstetricians, among them Krönig, Winter, Zangmeister, and others. In an extreme form it leads to a complete abstention from all forms of local treatment. Winter believes that retained fragments of placenta rarely lead to severe infection, but possibly may cause absorptive fever or toxæmia with superficial decomposition. He therefore considers that any attempts at removal are unnecessary and, moreover, are dangerous, as they are not infrequently followed by the development of a grave

type of infection which might have been avoided by leaving Nature to take her course.

These opinions are in marked contrast to the teachings of the profession in the past, when emphasis was laid on the importance of at once instituting active treatment with uterine douching, curetting, or écouvillonnage. The advocates of each extreme have claimed good results, but it would seem to the writer that a middle ground might still be the best to pursue. If on the very first appearance of symptoms it is suspected that the uterus is not entirely emptied of its products, it should be gently explored with the gloved finger and wiped out with pledgets of sterile cotton on an applicator or in the grasp of uterine dressing forceps, after which the tincture of iodine may be applied to the entire cavity of the uterus. Having satisfied oneself then that the uterus is empty, no further local treatment, examination, or manipulation should be allowed. If the temperature and other symptoms of infection persist the expectant treatment as outlined by Mermann would seem to be the most sensible and to give the best results. At any rate, further local interference with the uterus can do no good, but may and usually does result in a great deal of harm. The practitioner should always remember that the temptation and the tendency are to do too much rather than too little.

The Douche.—The influence of attempts to disinfect the vagina by vaginal douches before labor, which is still practised in some quarters, has been shown by Leopold, Krönig, Baisch, and others to be accompanied by a distinct increase in the morbidity from puerperal infection. Krönig has shown that the healthy vaginal secretion possesses distinct bactericidal power against pathogenic organisms artificially introduced. If it were not for this power, which is one of nature's wise economies, it would seem almost miraculous that women of the lower classes who are both ignorant and dirty, as well as careless, could ever escape the dangers of infection from childbirth. Vaginal douches cannot destroy the bacteria in the vagina, and antiseptics almost certainly exert an injurious influence on the vaginal epithelium and its secretions, thus diminishing the resisting power to infections.

The intra-uterine douche is only required if there is reason to believe that after delivery organisms have effected an entrance,

since it is a fact that after labor the normal uterus is sterile. In certain cases of operative delivery associated with the introduction of the hand into the uterus and intra-uterine manipulations it should be used, especially if the surroundings are not all they ought to be. After simple forceps delivery or version the douche is rarely necessary, but if it has been necessary to introduce the hand to effect removal of the placenta or fragments of membranes it is indicated.

Care must be taken to insure the complete evacuation of all the fluid after a douche has been given. The fluid should not be forced into the uterus under pressure, as this may be followed by symptoms of an alarming nature, and fluid may be made to enter the peritoneal cavity through a patent Fallopian tube or may be forced into the open sinuses of the uterine cavity. The hand should be kept on the fundus of the uterus during the entire irrigation to see that there is no undue distention.

Experiments have proved that it is quite impossible to render the uterine cavity free from infection by the douche. Krönig found that streptococci were just as abundant a few hours after the douche as they were before, and were just as virulent. The douche, however, may be of value in those cases in which the uterus is not draining properly and there is a retention of lochial discharge or blood-clot with signs of decomposition. The beneficial effects here are due more to the establishment of free drainage and the washing out of débris and soluble toxic products of bacterial activity than to any specific action of the fluid used.

Nearly every known antiseptic has been used for the purpose of intra-uterine douching, and it is not necessary to enumerate them here. Normal salt solution is perhaps better than any of them and will give as good results. Several writers in the last few years have reported favorably on the use of alcohol, washing out the uterus with a 5 or 10 per cent. solution or packing the uterus with gauze which has been soaked in alcohol. Personally I have not had much experience with this method.

If any antiseptic is to be used iodine is perhaps the best. It is thought to stimulate tissue reaction by inducing a condition of local leucocytosis, and it is very penetrating. In a douche it should be used in solutions of from 1 to 5 per cent. in strength. In my

hands the most effective way has been to carefully pack into the uterus a strip of iodoform gauze saturated with the ordinary tincture. It is necessary to squeeze out the excess of iodine from the packing before inserting it, mopping up the surplus with alcohol sponges so that the vaginal tissues may not be burned. I have frequently left this packing in for twenty-four hours. Polak, of Brooklyn, however, leaves it in only about thirty minutes.

Curettage.—Anæsthesia is usually necessary for thorough evacuation of the uterus by the finger. After thorough disinfection of the vulva and vagina an Edebohls self-retaining speculum is introduced and the vaginal wall thoroughly cleansed with pledgets of antiseptic cotton or gauze. The uterus should now be steadied with volcellum forceps and the gloved finger inserted into it, while the other hand should press down the fundus through the abdominal wall. The whole cavity of the uterus can usually be thus investigated. Under normal conditions the cavity should feel smooth except at the placental site, which may be identified as a roughened and irregular area projecting slightly above the surface. If there is a portion of the placenta retained it may be recognized as a mass projecting into the uterine cavity and may be separated by using the finger as a curette. After all loose fragments have been separated and removed the surface of the uterus may be gently rubbed with cotton or wool on an applicator, or swabbed out with the tincture of iodine. Sometimes if there is much débris it may be advisable to use an intra-uterine douche of normal salt solution.

Ecouvillonnage.—The intra-uterine brush has been used abroad quite extensively for the removal of retained products, but is not generally in use in this country. It resembles a bottle brush, and the decidual débris is cleaned out of the uterus very much as a bottle is cleaned with that instrument. It is claimed that it does not injure the mucous membrane of the uterus, and is a favorite mode of emptying the uterus among French physicians.

The Curette.—Curettement has been more discussed, perhaps, than any other operation in the field of gynæcologic and obstetric surgery. The current literature teams with articles on the subject pointing out the dangers and risks of the curette. There is no doubt that it is sometimes useful in skilled hands in emptying the uterus of retained products of conception, but its dangers are so great

that in the hands of the average practitioner it should be rarely used in the puerperal uterus. In spite of the repeated warnings of those most experienced in its use, and who undertake the use of it with fear and hesitation, yet every tyro is confident that he can use it with the boldness and skill of an expert and hesitates not "to rush in where angels fear to tread."

The writer will not attempt in this short article to give all the arguments for and against the curettement of the puerperal uterus, but will be content to state his own experience, based upon a large number of cases. An important distinction must be made in the consideration of this question between infection occurring as a result of abortion in the early months of pregnancy and infection after labor at or near full term. After abortion the results of curettement are almost invariably favorable, whereas after labor at or near full term the curette is a dangerous instrument and is more injurious than useful.

The time for action is on the first rise of temperature. A thorough investigation of the pelvic organs should be made. If the uterine cavity contains a considerable quantity of débris, such as adherent placenta, blood-clot, or necrotic decidua, which cannot be removed by the finger, by rubbing the surface of the cavity with gauze swabs, or an intra-uterine douche, then a large, broad curette, such as that used by B. C. Hirst, may be gently passed over the surface of the uterus. Such a curette will remove the débris effectively without injuring the mucosa. This should be done in the very beginning of trouble. After infective organisms have penetrated the body of the uterus, or have spread to the lymphatics, or general infection has taken place, such treatment is useless and is productive of great harm to the patient.

Curettement should be reserved for those cases in which the retained products cannot be effectually removed by the finger, the intra-uterine douche, écouvillonnage, etc. In determining the matter some assistance may be derived from the character of the lochia. If this remains abundant and foul smelling after the uterine douche, and digital exploration reveals the presence of necrotic tissue which cannot be removed by the finger, then the operation is a reasonable procedure, but it must be done with the greatest

skill and care. If the lochia is scanty or purulent and evidence of retained products is not present, then the operation is contra-indicated. If the uterine cavity presents a smooth surface, as it does in many cases of severe streptococcic infection, then a curettement is probably the worst thing that can be done, so far as the patient is concerned, and it should be absolutely forbidden, for it is in these cases that the most harm will be done by its use, and the result may prove fatal to the patient. It is not to be denied that in some cases where fever follows delivery there is a prompt subsidence of the symptoms following curettement, but these cases are almost always cases of sapræmia and would terminate favorably spontaneously or under other treatment.

Treatment by Drugs.—The treatment of puerperal infection by drugs is expectant and largely symptomatic, and may be found in standard text-books on the subject. Collargol has been extensively tried abroad and in this country intravenously, by the mouth, and by inunctions, but the results do not show any conclusive evidence of its value, though in a certain percentage of cases it has seemed tc be useful.

Nuclein has been recommended by Schauta, Hoffbauer, and Pollak. They advise it to be given in all cases of severe septicæmia. It has the advantage of being quite free from risk and is said to definitely increase the leucocytosis, thus inducing immunization against the infection. I have had some cases in which it has seemed to be of benefit, but its value as a mode of treatment has not been very definitely established.

Ergot is useful in a certain class of cases in which the uterus is flabby after labor, poorly contracted, and the lochia is offensive. The oxytocic action of the drug will stimulate the uterus to expel its clots and putrid discharges as well as tighten up the sinuses, thus minimizing the absorption of toxic products.

Intravenous Injections.—The intravenous injection of antiseptics has been suggested as a means of destroying the organisms of septicæmia and pyæmia, but if any of these substances are used in strong enough solutions to do any good they must inevitably injure the tissue cells. This mode of treatment is too dangerous to merit any attention.

The washing of the blood by salt solutions given intravenously, under the skin, or in the rectum, has been of decided benefit. Salt solutions not only dilute the toxins circulating in the blood but are of advantage in promoting elimination. Hirst uses a solution composed of calcium chloride 1½ grammes, potassium chloride 11½ grammes, to 34 ounces of normal salt solution, which he claims is more efficacious than the normal salt solution.

Abscess of Fixation.—This method of producing leucocytosis and thereby promoting recovery has been much discussed, but so far has not been adopted as a reliable procedure. The abscess may readily be produced by injecting one or two drachms of turpentine into the loose cellular tissue of the abdomen. In the course of three or four days an abscess forms. It is claimed by its advocates that the formation of the abscess, which it is important not to open prematurely, is followed by an amelioration of the symptoms. If there is no tissue reaction and the abscess fails to develop the patients usually die.

Serum Treatment.—This has now been before the profession for about fifteen years, and has been extensively adopted. It has, however, been very disappointing in results, and the statistics of many observers do not show conclusive evidence of the value of the treatment. In a few cases of streptococcic infection the antistreptococcic serum seemed to have been of benefit. It is, of course, useless in acute localized forms of infection of the pelvic cellular tissue or the peritoneum, and can only exert a beneficial influence in cases of general blood-infection. It must also be used in the early stages when the organisms are limited. We have seen how hard it is to be sure in the early stages that the infection is streptococcic, because in the examination of the lochia streptococci are often present in the normal uterus and often absent in the most virulent form of infection. By the time that the streptococcic infection has established itself by the severity of the clinical symptoms it may be too late to accomplish much with the serum, and it is difficult in most cases to prove that the infection is not a mixed one. Lea regards the antistreptococcic serum of little value in cases of thrombophlebitis, pyæmia, and ulcerative endocarditis, but Polak claims to have had some good results from its use.

The use of vaccines made from the killed bacteria has seemed

to be a little more encouraging, but the committee of the American Gynecological Society, reporting on the use of vaccines, May, 1910, says: "It would appear that the greatest prospect for the successful use of vaccines is in chronic local infections, and that they offer little hope in acute general infections where aid is so urgently needed." Quoting from Polak, he says: "Our experience convinces us that while it is a mistake to imagine that we have a panacea for all infections in bacterial vaccines, to the exclusion of surgical procedures and general supportive measures, vaccine therapy has a place and serves a distinct purpose as an adjunct to the established modes of treatment."

Most can be expected from bacterial vaccines when the process is local. Autogenous vaccines of a single strain have not given very reliable reactions. They are less likely to effect a defence than when a vaccine of polyvalent strain is used. Here the results have been fairly good. The mixed vaccines or bacterins put out by reliable laboratories have given a better result than when a single strain was used.

Nutrition.—It is now generally conceded that the administration of abundant and nutritious food up to the limits of the digestive powers is a factor of the greatest importance in the treatment of any grave form of infection. It is just as important to keep the nutrition of the patient up to its highest point in puerperal infection as it is in typhoid fever, and for the same reasons. Experience has demonstrated that it is quite impossible to compensate for the greatly-increased destruction of the nitrogenous elements of the tissues by giving large quantities of proteid foods. Hutchinson claims, therefore, that it is very much wiser to administer a diet containing a large proportion of the carbohydrates, which have a tendency to limit the amount of proteid destruction.

The Operative Treatment.—The high mortality which attends the severe forms of puerperal infection has induced many efforts to save life by operative measures. It is difficult to lay down general rules for guidance, and exceptionally good judgment and wide experience may be required to make the right decision as to when to operate and when not to do so. If the general condition of a patient with high temperature and quick pulse seems to be getting worse, and there can be demonstrated in conjunction with this

some local form of infective process, then the question of operation must be considered.

Suppuration in the pelvis may be the result of inflammation of the pelvic cellular tissue or may arise from peritoneal infection either with or without the formation of pus in the appendages. Attempts have been made to cut short the course of a pelvic cellulitis by early free incision and drainage, but have not given very satisfactory results. It must not be forgotten that large masses of exudate may be absorbed in the absence of any formation of pus. It is, therefore, inadvisable to undertake any operative interference unless there is definite evidence of the formation of pus. If the exudation has formed in the upper part of the broad ligament an incision may be made in the abdominal wall parallel to Poupart's ligament. The abscess may in this way be evacuated without entering the peritoneal cavity. If the abscess fills the most dependent part of the pelvic cavity—namely, Douglas's pouch—then an incision through the posterior vaginal fornix may be made and the pus evacuated.

Suppurative Disease of the Appendages.—The formation of pyosalpinx in the course of puerperal infection is rare and is usually the result of a pre-existing gonorrhœa. A pus tube may have existed, however, before the pregnancy occurred, and I have frequently observed a run of temperature and an elevated pulse and other symptoms of puerperal infection which were due to an old pus tube. The onset of labor in these cases has seemed to light up the smouldering fire.

Abscess of the ovary, however, not uncommonly develops as a result of lymphatic infection of the uterus or the pelvic cellular tissue. The pus in cases occurring after delivery is of a highly virulent type, and if peritonitis of a diffuse kind takes place it is rapidly fatal. Any attempt at removal of infected appendages through an abdominal section is therefore attended by grave risk of setting up a diffuse peritonitis. The danger is particularly great if the infection happen to be from the streptococcus. If the presence of pus is detected after childbirth the wisest course is to perform a posterior colpotomy and drain the pus sac from below. In subacute cases in which there is no immediate danger to life all operative treatment should be avoided as far as possible until the

virulence of the pus is attenuated and the acute stage has passed off. Then treatment should be instituted by an abdominal section.

Peritonitis.—The mortality of puerperal peritonitis has always been high. The adoption of surgical procedures in the last few years has been attended with some degree of success. It is not probable that the results will ever be so favorable as those obtained from peritonitis caused by a localized abdominal lesion, such as appendicitis, perforating ulcers of the stomach or intestine, etc., as it is rarely possible to completely remove the cause of the infection. There is a class of cases of very severe streptococcic infection in which there is slight evidence of peritoneal reaction. There may be the flat belly and subnormal temperature, and the coils of intestine united by a fibrinous or purulent lymph. Death always ensues in these cases in three or four days, and they are quite beyond surgical or any other kind of treatment.

If the infection is limited to the pelvis, then posterior vaginal section should be done promptly. This is especially valuable in the early stage of lymphatic peritonitis spreading from the uterus and broad ligaments, but it should never be done in the diffuse forms of peritonitis, as it is too inadequate to meet the grave conditions present.

The early diagnosis of the presence of general puerperal peritonitis presents great difficulty. If an operation is to be done at all it should be done early, and if we wait until the disease has fully developed valuable time will be lost and the operation will be undertaken too late to save life. On the other hand, inasmuch as we know that many cases will subside spontaneously and the symptoms clear up, it is certainly unjustifiable to open the abdomen in every case on the first appearance of symptoms of peritonitis.

Very frequently the symptoms of peritonitis develop gradually and a variable amount of seropurulent fluid is poured out. These are usually the less virulent cases, and abdominal section followed by the Murphy drip and the Fowler position saves many lives. In some instances localized collections of pus occur, being especially liable to form around the appendages, in the pouch of Douglas, or in the iliac fossa. The results obtained here by incision and drainage are good.

In diffuse peritonitis abdominal section is the operation of

choice, for it has the advantage of permitting a complete exploration of the whole abdominal cavity. Sometimes unexpected conditions may be discovered as the cause of the infection which had hitherto escaped detection, such as ruptured appendix, tumor of the uterus, or diseases of the appendages. Drainage should preferably be through the vaginal vault, though in some cases it may be through the abdominal incision or a stab-wound. The best results will be obtained by a simple irrigation with normal salt solution at a temperature of 100° F., avoiding as far as possible any handling or manipulation of the tissues, and not attempting to detach flakes of lymph as was formerly done, for these are a part of nature's own protective.

Thrombophlebitis.—The remarkable success obtained in the treatment of aural pyæmia by ligature and excision of the jugular vein has stimulated attempts to carry out similar modes of treatment in pelvic thrombophlebitis. Trendelenburg, in 1902, removed septic thrombosed veins for the relief of puerperal infection. Successful operations of this kind have been also reported by Williams, Freund, Bumm, Vineberg, and Seligmann.

The diagnosis of thrombophlebitis is not attended with particular difficulty. Repeated rigors form a characteristic feature in almost all cases, though occasionally they are absent. Trendelenburg, Bucura, and others advise operation after the third or fourth rigor. Lea thinks this a little early in view of the fact that about 40 per cent. of the cases will get well spontaneously. The mortality is high. Forty cases, including five of his own, were analyzed by Whitridge Williams, showing a mortality of 43.9. The best results have been obtained in the subacute or chronic cases operated upon four to six weeks after delivery. There is little doubt that a considerable number of such cases would get well without any operation. It is not possible up to the present time to formulate precise indications for the operation, and owing to its gravity it is not probable that it will be adopted by the profession generally.

Hirst says: "If abdominal section is done because thrombophlebitis is suspected, many an unnecessary operation will be done. I have very rarely indeed seen a condition of the ovarian veins that called for their ligation or removal. Thrombophlebitis as the sole cause of an operation and as the only thing to be removed is

not yet demonstrated to the majority of surgeons." Polak believes that thrombophlebitis is a conservative process on the part of nature to limit infection, and that any form of pelvic manipulation only tends to break down and separate parts of these thrombi, extending the infection to the more remote parts, thus jeopardizing the patient's life.

Hysterectomy.—The question of the removal of the uterus as a mode of treatment in certain cases of puerperal infection is one that is attended with some difficulty. If there have been extensive injuries to the uterus, such as a rupture or a perforation, or if there is an infected tumor, such as a myoma, or if an abscess of the uterine wall can be diagnosed, the operation is clearly indicated. If the operation is performed simply in the hope that a fatal result from septicæmia may be averted, it is very much open to question. It is difficult or impossible to recognize the moment when it can be said that the infection is confined to the uterus, and if it has gone farther than the uterus the operation cannot remove the infection. If the operation is delayed until infection is established it may be too late and will only precipitate the fatal issue. If done early we subject the patient to the risks of a grave operation, and in many cases she would have recovered spontaneously anyhow. There is the further danger of conveying infection to the peritoneal cavity, or of opening up fresh lymphatic spaces, and the fresh wound surfaces may readily become a source of renewed infection. The mortality where hysterectomy has been done in puerperal cases has reached 70 per cent. This is considerably higher than the death rate from puerperal infection of severe types treated without operation.

Vaginal hysterectomy has been championed as being less liable to general infection and accompanied with less shock. This, however, has obvious disadvantages. The enlarged uterus is friable and more subject to lacerations. On account of the infiltration of the broad ligaments the danger from hemorrhage is greater and it is harder to make a thorough exploration of the pelvic and abdominal cavities. It may be of use sometimes in cases of septic abortions or the later stages of the puerperium, but the method, on account of its difficulties, has largely been given up.

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Ophthalmology

SOME OCULAR MANIFESTATIONS OF HYSTERIA *

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The ocular manifestations of hysteria should be of great interest to the physician as well as to the ophthalmologist. Charcot was the first one to insist that our investigations and studies of hysteria should be from a physiological standpoint instead of an anatomical one. In other words, we might say that hysterical symptoms do not necessarily imply a lesion of an organ, nerve or of a nerve-centre, but rather a disturbance of function. The latter-day studies of hysteria from the *psychological* side of the question have been the means of clearing up many doubtful points in the diagnosis of this most complex disease. The more we study our hysterical patients the more we are convinced that the hysterical subject is not a clever simulator, as was formerly believed, but a sufferer from a genuine disease. Considered from the ophthalmologist's point of view, the ocular manifestations of hysteria are singularly constant and dependable, the symptoms being quite definite in many of the cases.

De Schweinitz has given a very good classification of the ocular manifestations of hysteria, but I have changed his classification to some extent in this paper. The different affections of hysteria have been placed in their anatomical order; that is to say, hysterical affections of the eyelids, of the extra-ocular muscles, of the intra-ocular muscles, *i.e.*, the iris and the ciliary body, of the retina, and the optic nerve. Let us therefore classify these various affections more in detail as follows:

1. Those affecting the movements of the eyelids and extra-ocular muscles, such as *contractures, spasms,* and *palsies.*

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* Read before the Tri-Professional Society at Hotel Astor, Dec. 21, 1911.

2. Those affecting the movements of the iris, or *pupillary changes.*

3. Those affecting the movements of the ciliary body, or *accommodative changes.*

4. Painful visual sensations, or *asthenopia.*

5. Partial loss of vision, or *amblyopia.*

6. Complete loss of vision, or *amaurosis.*

7. Other ocular changes not included in the above and at present impossible to classify, such as disturbances of sensation and secretion affecting the lachrymal gland and the skin of the eyelids. This classification will readily show the wide and varied disturbances that the eye alone can present in hysteria. Hysterical affections may be spoken of as those of permanent duration, which means that they may last for years, or those which are transitory, lasting for days, weeks, and months.

Class 1.—There is a condition, frequently seen, affecting one or both eyelids, which we call blepharospasm. This may be of two forms, the clonic and tonic. In the clonic form we have continuous blinking of the eyelids, which may be seen as a constant vibration or trembling of the closed or half-closed lids. This condition may persist even during sleep. The tonic variety is convulsive. The skin of the lids is forcibly folded and the palpebral margins are tightly closed. It will be found difficult to open the lids with the fingers, and there is usually marked photophobia associated with the tonic form of blepharospasm. From the clinical standpoint there are also two forms of blepharospasm, the painful and nonpainful. These spastic affections of the lids may appear suddenly and disappear in the same manner, or they may last for years. Hysterical blepharospasm may be due to a spasm of the orbicularis palpebrarum muscle or to a hypersensitive condition of the retina. We may see at times pseudoparalytic ptosis caused by a cramp or spasm of the palpebral portion of the orbicularis. This condition must not be confounded with true ptosis or paralysis of the levator palpebral muscle. In pseudoparalytic ptosis the upper lid droops without much wrinkling of the skin, which condition is more or less constant in true ptosis. The lids, if raised by means of the fingers, when released fall more rapidly, and the patient may, if his thoughts be decentered for the moment, open the lids. These hysterical patients very often are able to open the eyes in the dusk or in a dull light. Landolt has

pointed out the following test for making a differential diagnosis between ptosis and orbicular spasm and between paralytic and hysterical ptosis (*International Clinique,* 1901). The differential diagnosis between paralytic ptosis and closure of the lids from spasm of the orbicularis is readily made by observing the patient's forehead. Where there is paralysis of the upper lid, the eyebrow is elevated, because the patient tries to lift the eyelid by contracting the frontalis. In spasm of the orbicularis the eyebrows follow the contraction of this muscle and descend below the normal line.

Differential diagnosis between paralytic and hysteric ptosis: "Suppose a patient whose upper lids are lowered is brought to me. She pretends to be unable to open her eyes. I place her in front of me and tell her to look fixedly at one of my eyes. To do so, she inclines her head strongly backwards so that her gaze may pass under the drooping lids to my eye. Then I put my hand on the top of her head and exhort her energetically to continue to look at my eye. At the same time I raise my head. I incline hers gradually forward. If the pupils of the patient remain uncovered during this procedure I have evidently to deal with hysteria, because, to affect this, the lids have to raise themselves with the eyes whilst the face is lowered; in fact, keeping the eyes open whilst the head is inclined forward is equivalent to raising the eyes and lids when the head is straight, a thing absolutely impossible in paralysis of the levator palpebræ, in which the patient ceases to see objects as soon as the head leaves the compensating position, because the lids cover the pupil immediately." Another picture presented in hysteria is spoken of as hysterical paralysis of the levator palpebræ or flaccid hysterical ptosis. This form of paralysis is denied by Charcot and Borel, but it is defended by Schmidt-Rimpler, Kiemann, and Wilbrand. They claim that the ptosis is due to a relaxation of the levator fibres. It is usually bilateral and may come on gradually or suddenly, and is often accompanied with many of the other hysterical ocular disturbances, such as amblyopia, or amaurosis and contraction of the field.

CASE I.—Miss G. B., æt. 13, white, general health good and family history negative, except for the mother, who had acute glaucoma 20 years ago. At the present time we can see the coloboma from the iridectomies which were done at the time. About five or six months ago patient noticed that the upper lid of the left eye began to droop, and she was unable to elevate it at these times. This was not continuous during this period of months. On October 15, 1909,

she presented herself at the New York Ophthalmic and Aural Institute and on examination we found a slight drooping of both lids, though much more pronounced on the left than on the right side. She was able to elevate both lids when an effort was made to do so, but whenever she fixed her eyes on an object for a few seconds the ptosis would again present itself. This condition was more constant on the left side, the opening between the lids being 5 mm. Forehead wrinkled and brows raised from the constant effort to open the lids.

202. Pupils are 4.5 mm.; irides brown, and reacting to light, accommodation, convergence, and tension normal. Vision OD. 5/5, OS. 5/9, and the accommodation is O.D. 8-54 mm., OS. 8-56 mm., Jaeger No. 1.

Ophthalmoscope.—O.D. Media clear, disc is oval 7x8, long axis 90. Scleral ring all around, central excavation small, vessel long axis 90°.

OS. Media clear, disc is oval, long axis 90. Scleral ring all around, central excavation small. Veins dark and full, vessels long axis 90°.

The corneas were hypersensitive and there was photophobia and marked lacrymation. There is a fibrillary tremor of the orbicularis muscle, and patient says that she is conscious of the same.

11-19-'09. Vision OD. 5/4, OS 5/4. Accommodation OD. 6-50, OS. 6-50, Jaeger No. 1. Patient inclines the head backwards so as to see through the partially closed lids. Sensation of the cornea, nasal and pharyngeal membranes somewhat plus. Temporary diplopia for near. The ptosis is so complete on the left side that it is not possible to make her open lids by any suggestion. Many psychological suggestions were tried, but failed to make her open her eyes. At different times patient walks in her sleep, but has never fallen or hurt herself in any of her somnambulistic spells.

11-30-'09. This morning, on arising, the right lid was well open and the left partially so. Later in the day the ptosis returned in its usual manner. Sensation over the skin of face and body normal. Station good, coördination fair, gait normal, the reflexes were perhaps a trifle increased.

1-11-'10. On arising the lids were both open to the normal degree and there was no manifestation of the ptosis. This has occurred quite frequently of late, but later in the day the drooping returns. Study and any attempt to use the eye cause the ptosis to appear.

When one lid is forcibly elevated with the finger the lid on the opposite side falls, covering the eye completely. Glasses were prescribed at this time, thinking that they might relieve some of the sensory irritations. She was given OD. +0.50cyl axis 90° OS. +0.25 cyl. axis 90°, constant wear.

3-11-'10. Able to open her eyes better and the lacrymation is much less. Still the diplopia, but not constant.

6-11-'10. The ptosis is very much less on the left side and, in fact, at times it is entirely absent. Now we find that the ptosis is much more pronounced in the right lid. This is a direct reversal of the paresis. A photograph that was taken at this time shows the order of things. She has greatly improved under treatment up to this time, and I have always assured the mother that the condition would eventually clear up.

2-4-'11. Patient has been under observation for nearly a year and a half and the ptosis has changed to the right side, as above stated. The ptosis would change from one lid to the other in the midst of an examination. Patient is thoroughly conscious of the fact that the ptosis changes from one eye to the

Fig. 5.

These photographs were taken at different times in groups of three. The upper row was taken three months after the ptosis (?) appeared. The lower row one year later, showing that the ptosis had changed from the left to the right eye.

other and that thinking about it always makes it worse. If her friends speak to her of the condition it is always more marked. During the treatment she has gained about twenty pounds in weight. Her general health was never better. She is a good student and her standing in her school and class has always been the very best. The presence of the ptosis has not interfered with her studies and work in any way. She is now becoming more and more conscious of the condition and is especially anxious to get well. When I first saw her she was not worried about the trouble and seemed to enjoy the novelty of the disease. She is now more anxious to get rid of the disfigurement.

The fields that have been taken through the period show great differences. This is not unlike most of our hysterical case histories. There has been the dischromotopsia. This I have been able to demonstrate a number of different

FIG. 1.

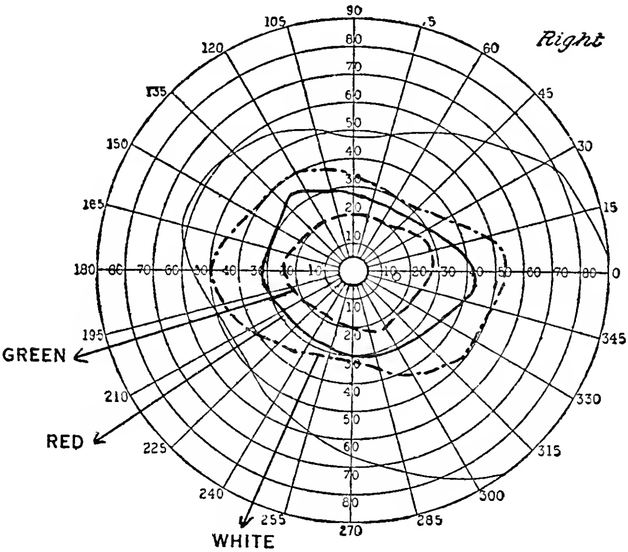


Chart shows concentric contractions, but no scotoma. 10 mm. disc. Date, 11–5–'09.

times, and the copy of the field that is shown was made 3-8-'10. The upper portion of the field was cut off by the drooping of the lids, and when they were held up the upper boundary was out beyond the normal limit of white. (Figs. 1–5.)

1-6-'11. Lids are open most all of the time. There is still some drooping of the right late in the afternoon. Patient is generally much improved since she has been under treatment of Dr. Beling, who has used hypnotic suggestion. During this examination she was told to close her eyes and remain perfectly quiet. After a few seconds of quiet I clapped my hands before her eyes and she immediately opened both of them wide. The lids of both eyes remained open for about two or three minutes. Cocaine dropped in the eyes showed no change in the palpebral openings. There is still some diplopia for near but

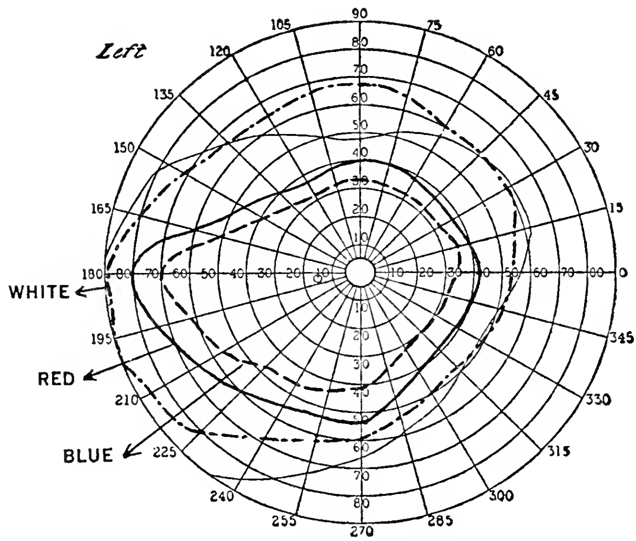
none for distance. Convergence is weak on the right side, but, on looking to the left, eye is rolled far into the inner canthus, showing no loss of the converging power of the internal rectus, except when she attempts a coördinate act in this muscle. Dischromotopsia is demonstrable at the present time.

Report of Dr. C. C. Beling.—January 7, 1912. Patient complains of a drooping of the right upper eyelid.

Family History: Negative.

Personal History: Her birth and growth were normal. In childhood she suffered from nightmares, somnambulism, and frequent dreams. About two and one-half years ago she says she went down to the cellar, when a boy jumped out from behind the cellar door. and gave her a sudden fright. Soon after this incident she had an hysterical attack in the bathroom and a little

Fig. 2.



Reversal of colors (dischromatopsia). 10 mm. disc. Date, 3–18–'10.

later was somnambulic. Referring to this period she says: "Two or three times I had peculiar spells; when I tried to stand on my feet, my head began to swim and I could not stand." Shortly after the fright it was noticed that the left upper eyelid drooped. Six months later the right upper eyelid was similarly affected. Since then there has been an alternating ptosis in one eye or the other. Recently, however, the ptosis has been confined to the right eyelid.

Present Condition: Careful examination fails to reveal any organic disease. There are no sensory disturbances of any kind. The right upper lid is in a condition of partial ptosis, which becomes aggravated when her attention is directed to it. With it is associated an elevation of the right eyebrow, which seems to be due to a more or less continued effort to open the eye. With in-

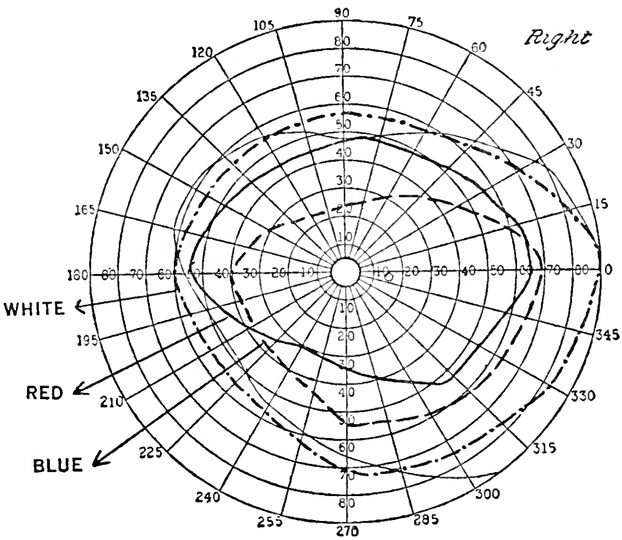
creasing ptosis the eyebrow is more markedly elevated. The left eyelid is normal. The movements of the eyeballs are normal.

Under light hypnosis and suggestion the patient opens both eyes widely and normally. Right ptosis recurs later.

The superficial and deep reflexes are all present. The knee reflexes are somewhat increased. There is a tenderness on pressure over the right temporal fossa, just above the zygomatic arch. Palpation reveals a thickening, which can be felt under a freely movable skin. The patient, however, has not complained of this.

Diagnosis: Functional paralysis of the right levator palpebræ superioris. Associated contraction of the right occipitalfrontalis (mostly voluntary). Emotional states and repeated examinations have probably tended to retard recovery.

Fig. 3.

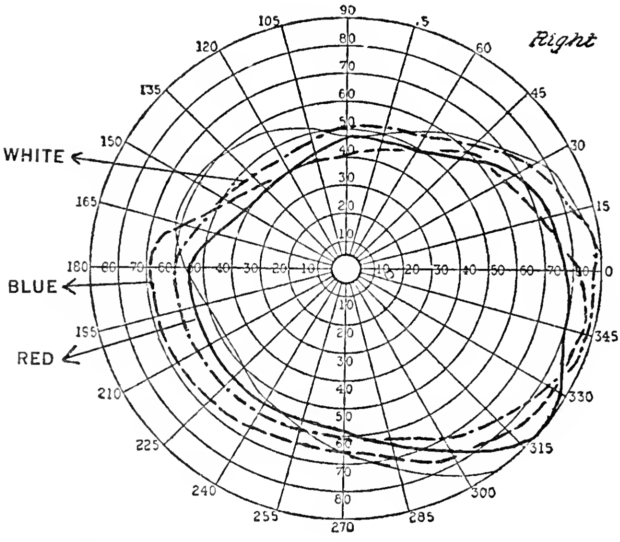


Reversal of colors (dischromatopsia). 10 mm. disc. Date, 3–19–'10.

Hysterical affections of the extra-ocular muscles may select any one or group of muscles, presenting all degrees of paresis. There may be excessive or insufficient action of any one or all of the muscles of the eyeball. Koenig states that there has never been a true case of hysterical paralysis of the external eye muscles published. These affections should be regarded as cramps or contractures, just as we see contractures affecting any of the muscles of the body. The spastic strabismus seen in the hysterical is really a contracture of convergence, and is often seen at the beginning of a grave hysterical outbreak. A permanent convergent strabismus must not be thought of

as a result of hysteria. In regard to palsies affecting individual muscles, we find a great diversion of opinion. A number of cases of paralysis of one muscle at a time have been reported by such excellent observers as Guttmann, Duchenne, Borel, Wilbrand, and Parinaud. Notwithstanding the fact that Parinaud has reported a case of paresis of the abducens and the third nerve, he says: "The so-called hysterical paresis should be explained by what are sometimes described as associated ocular paralysis—that is, although the eyes cannot make certain movements in which they are usually associated,

Fig. 4.



All color limits are enlarged, with reversal of colors. 10 mm. disc. Date, 11-11-'11.

the directing power of the muscles may be unimpaired when they exercise their function in a different direction. In other words, there is a paralysis of movement and not of the muscles supplied by a given nerve."

Class 2.—The pupillary changes are most varied and can be put down as:

(*a*) *Contractions of the pupil* or spasmodic myosis.

(*b*) *Dilatations of the pupil,* which may or may not respond to light.

(*c*) *Alternate contraction and dilatation of the pupil.*

These affections of the pupil have no definite duration, and they are usually bilateral, but cases of unilateral dilatation have been reported by Tourette, Mendel, and de Schweinitz. It is perhaps cortical in its origin, but a tonic cramp of the iris is a possibility without the pupil reacting to light. It is a well-known fact that it is possible to have a tonic cramp of the arm and the biceps reflex be absent. Hare and de Schweinitz have reported a case of complete amaurosis with mydriasis of the right side, the dilated pupil reacting sluggishly to light and moderately to eserine, with marked myosis on the left side and moderate amblyopia in an hysterical woman in whom the condition had existed for many years. The use of drugs in this case had been absolutely excluded by keeping the patient under the observation of a nurse all the time. Some authorities claim that it is possible to make a differential diagnosis between epilepsy and hysteria by observing the pupillary reactions. In epilepsy the pupils are widely dilated and do not react to light or accommodation, whereas in hysteria the reaction of the pupil is retained.

Class 3.—We may have partial or complete loss of the action of the ciliary muscle. This muscle, as we all know, is chiefly concerned in the act of accommodation. *Hysterical cyclospasm* is made evident when an attempt is made to fix the eye upon a given object, which at first may be plainly seen and then later becomes indistinct and blurred. Diplopia or double vision may be present. In hysterical cycloplegia, or paralysis of the ciliary muscle, the patient is no longer able to fix or accommodate his eye for small objects, and is therefore unable to read fine print, due to the recession of the *punctum proximum* or the near point. This is best and most easily demonstrated by the Yeager reading test type. This condition is usually bilateral, accompanied, as a rule, with paresis of convergence, as the internal recti muscles are so closely associated with the ciliary body in the act of accommodation. The size of the pupils is generally unchanged, but cases with dilatation have been reported. Unilateral hysterical accommodative paralysis is very doubtful. These ciliary muscular phenomena must be considered as a form of spasm, and may be either partial or complete.

Parinaud, in speaking of these affections of the ciliary muscle, says that the loss of the accommodation and the diplopia are due

to some changes in the lens itself, which we know is directly affected by the action of the ciliary muscle. He states, in an article published in the *Annals d'Oculistique,* 1898, that: "The disposition of the anterior portion of the lens in three segments favors the change in curvature, but at the same time, owing to their separation from one another by layers of amorphous material, each section possesses a focal point of its own, capable of producing images distinct from those yielded from the lens as a whole. The condition of spasm, by increasing the convexity of the anterior surface of the lens, serves to emphasize the diplopia arising from structural defects described." It does not seem to the writer of this paper that the crystalline lens is capable of having such great changes take place in its size, shape, and structural arrangement as to explain all the symptoms that are present in this condition. I am more inclined to believe that here again the psychical forces of hysteria are in evidence and can better explain these phenomena.

Class 4.—A certain number of our hysterical patients present what is known as asthenopia, or painful vision. This condition is accompanied with photophobia, lachrymation, and pain in the temples. Most all of these symptoms can be explained by a hypersensitive condition of the retina. The various symptoms have been spoken of as "*hysterical kopiopia,*" "*hysterical ocular pain,*" and "painful accommodation." There is, as a rule, no reduction of vision, but any attempted use of the eyes is followed by ocular pain, headache, and micropsia. Continued use of the eyes in this phase of ocular hysteria is an impossibility, and these patients often wear tinted glasses to relieve the symptoms complained of.

Class 5.—In the cases of *hysterical amblyopia,* or temporary reduction of vision, we usually find that the visual field is concentrically contracted. One of the peculiar changes found in the visual field is known as dyschromotopsia, or reversal of the normal relation of colors. This condition is due to an anæsthesia of the retina, in contradistinction to the hyperæsthesia which we find in the cases of asthenopia. The visual acuity is suddenly lowered in what was previously a normal eye, often without any apparent cause. We are unable to demonstrate any refractive error or any ophthalmoscopic changes in the fundus. The fields of vision may show a variety of changes from the normal. Most frequently we find concentric con-

traction of the field, according to de la Tourette's investigations. Dan says that "this is almost a constant symptom in hysterical patients and the most common of all the forms of anæsthesia." There may be many variations from the normal field found in our hysterical patients. In the normal color field *white* is first seen, then follow *blue, red,* and *green,* occupying a regular position and bearing a relative relation to each other. In hysteria this relation is usually disturbed, and we may find inversion of the red and blue, more rarely of the green. Cases have been reported where the red color may even take the limit of the white field. Hysterical amblyopia may come on without any apparent cause, or it may follow traumatism, affecting one or both eyes. It may last for any period of time, that is to say, for days or even for years.

CASE II.—K. F., æt. 25, was first seen by me when she was a patient in a hospital, suffering from general hysteria. She was being treated by the daily use of the actual cautery along the spine. Patient was later discharged from the hospital cured. About one year later she was working in an umbrella factory and was accidentally struck in the right eye with a rib of an umbrella. She was brought to my office half an hour later. She was in great distress of mind and told me that she could not see with the right eye.

When the vision was tested she was able to read as follows: O. D. 20-200, O. S. 20-20, accommodation normal in the left and gone in the right. Examination of the right eye failed to reveal any injury to the cornea, media, or fundus. Most careful ophthalmoscopic study gave no explanation for the great reduction of vision. Previous to the accident the visual acuity in the right eye was 20-30 (I had examined her eyes for glasses). Test was made with lenses, and on placing a —0.5 spherical before the right eye the patient was able to read 20-50, but on removing this lens the vision again fell to 20-20. Placing again the —0.50 spherical lens before the right eye, the vision was again 20-50; then by placing a +0.50 spherical in front of the —0.50 spherical, thus neutralizing the first lens, the patient could read 20-20. In three days after the accident the vision returned to normal.

In these cases the vision may be very much reduced and the field may be perfectly normal, or the fields contracted and the vision normal. This was a case of traumatic amblyopia in which we had a clear history of shock. Charcot was the first one to call attention to this group of symptoms in hysteria and to describe them under the name of "*traumatic hysteria.*" This was disputed by Oppenheim and Thomson, who attempted to make these nervous symptoms a special disease to which they have given the name of "*traumatic neurosis.*" In case of doubt as to the identity of hysteria

or traumatic neurosis, the eye findings will often clear up the difficulty.

These cases may become of importance from a medicolegal standpoint. In making the diagnosis, one must bear in mind the necessity not only of measuring the visual field and determining the central acuity of vision, but also of establishing the presence of those accommodative and convergence changes which we know may exist without amblyopia. Traumatic hysteria leads us to a study of the so-called reflex amblyopias and those ocular symptoms that are produced as a result of peripheral irritation. In other words, we must seek carefully in all cases of supposed hysterical conditions for a possible underlying cause that may not be at first apparent but does ofttimes exist. Some of the hystero-traumatic-amblyopic patients may even simulate the symptoms of sympathetic ophthalmia. Parinaud has put on record three of such cases occurring in men and following an injury to one eye.

Class 6.—Hysterical amaurosis is complete loss of vision, affecting one or both eyes and lasting for hours and sometimes for years. The loss of vision is complete for objects and color, but there may be a slight perception for very bright light. This condition may come on slowly or suddenly, and in these cases there is complete absence of any defects of the cornea, media and fundus. Many of the other hysterical symptoms may be present. Harlan has reported a case of amaurosis which lasted for ten years in which the vision was finally restored. The prognosis is good, notwithstanding the gravity of the symptoms or their duration.

Case III.—Ralph G., æt. 17, student, good habits, previous personal history negative. Several members of his family wore glasses, but no serious eye trouble in any. Had his nose broken two years ago in a game of basket ball. Broken nose was not treated at the time. I was called to see him two hours after he had noticed, while tying his necktie before the mirror, the loss of vision in the right eye. Examination O. D.: Vision for objects and motion entirely absent; there was slight perception and reaction to light, but no gross changes were noticed, either externally or internally. He was sent to the hospital and the following morning the amaurosis had involved the left eye. He was not greatly disturbed, but was apparently indifferent as to the outcome of his present trouble. There was pronounced blepharospasm with the continual vibratory tremors of the lids. Upon forcible opening of the lids the pupils were found to be dilated and the eyes were rolled high up in the head. The cornea was anæsthetic—the sensation of the body was apparently normal for pain and touch.

There was, however, a curious reversal of sensation for heat and cold. He insisted that the ice-cold test-tube was red hot and that the hot tube was cold. Electrical reaction was apparently normal. After being in bed for three days and receiving electrical stimulation, massage, and increasing doses of Fowler's solution, he asked when he could return to school, and was told that he would not be able to go to school until he could see. In half an hour my patient announced to the nurse that he could see. When asked what was the first thing he saw, he said that he could see himself tying his necktie. There was no recurrence of this condition for a year and a half; after that time he passed from observation. His refraction after the restoration of his vision was O. D. =0.75 spherical, vision 20-20, O. S. —1.25 spherical, vision 20-20.

In way of explanation of this extraordinary condition, it might be said that the failure of vision is not due to any actual change in the retina itself, but rather to some change in the cortical centres. Harlan has suggested the following classification for these cases of hysterical amaurosis:

(*a*) Those who deliberately simulate blindness.

(*b*) Those who see unconsciously but are not capable of conscious vision.

(*c*) Those who are really for the time being absolutely blind.

The case just reported seems to belong to the second group. Some investigators have suggested the possibility of a toxin which is elaborated in hysteria and which affects the cortical centres.

Class 7.—There are still some manifestations in hysteria which cannot be properly classed in any of the above and only need mention in this study of the disease. There may be disturbances of the lachrymal gland, such as hysterical epiphora and bloody tears. We may have hyperæsthesia of the cornea and the conjunctiva. There may be hysterical chromadrosis which consists of a blackish or brownish discoloration of the eyelids which can be wiped away or which may last for months at a time.

Otology

CERUMEN (WAX) IN THE EARS

BY JOHN C. WARBRICK, M.D., C.M.

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The subject I shall treat is one with which all physicians are no doubt familiar and about which possibly many of them have ideas of their own. Some of the questions often asked by members of the laity in reference to the common occurrence of wax in the ears are: "How can I tell if there is any wax in my ears?" "How does it get there?" "How can it be got out?" "Is it dangerous to have it there?"

It may be said that it would be almost a rarity to find a person who has not at some time or other had more or less of this substance present in the ears. It is secreted continually in the normal state of health by the ceruminous and sebaceous glands of the meatus, and in time is gradually discharged from the canal almost without any attention being drawn to it. The secretion varies greatly, however, even in a state of health, in different individuals. In some a large amount of wax is secreted, while in others there may be no secretion whatever, but only flakes of larger or smaller size and brownish-white or whitish in color. This variation may be due to physical characteristics tending to modify the secretion and its formation, or to some peculiarity of the nervous mechanism. An increase in the amount of secretion may be caused by nasal and postnasal catarrh affecting the ear, colds, and some general affections. In cases of hypersecretion the wax is more likely to accumulate, especially if anything tends to interfere with its discharge. The consist-

ency of the secretion may vary, and it may be thicker sometimes and thinner at other times on account of certain bodily conditions or anything causing increased or diminished activity of the secretory glands.

To aid in the removal of wax from the ears a number of first-to-hand and rather dangerous methods are used occasionally. Some put the end of the little finger in the entrance and try to scrape it out, especially if itching occurs. Others may use the end of a match, the head of a pin, the end of a penholder, a hairpin, a toothpick, etc., for this purpose. A slight tickling sensation at times may be the indication for the use of any of the above-mentioned methods to probe the outer parts of the canal. When an accumulation of wax persists for some time and it becomes solidified and movable, it may act as a foreign body capable of producing symptoms according to its position and size, and which should, of course, be removed.

The wax is conveyed along the auditory canal to the opening chiefly by the movement of the jaws and the muscles acting upon them. In eating, yawning, and opening and closing the mouth, the motion at the intermaxillary articulation, especially in lowering the lower jaw and protruding the chin, draws the inferior wall of the meatus downward and also to some extent the anterior wall, while the posterior wall is drawn forward and down. Thus the opening is enlarged and the passage of any material in the ear toward the opening is facilitated. In the descent of the lower jaw and the protruding of the chin the motion is conveyed to the tympanic membrane and chain of ossicles. A side-to-side movement of the jaws also causes some action in the intermaxillary articulation, and if the head is held to one side the movement of any particles of wax toward the opening is quickened. The temporal muscle, by having its anterior fibres close the mouth, and its posterior fibres retract, also plays a part in the movements at the articulation. In cases where there is a discharge of watery mucus or pus from the middle ear, these movements at the intermaxillary articulation help the discharge of any secretion into the auditory meatus. This can sometimes be seen, by means of an examination with the otoscope, as a short but continued ebbing and flowing through a perforation made in the tympanic membrane into the meatus and along it. When the light is turned on the inner ear, the reflector makes it appear as a glittering, wave-like motion in the moonlight as it flows.

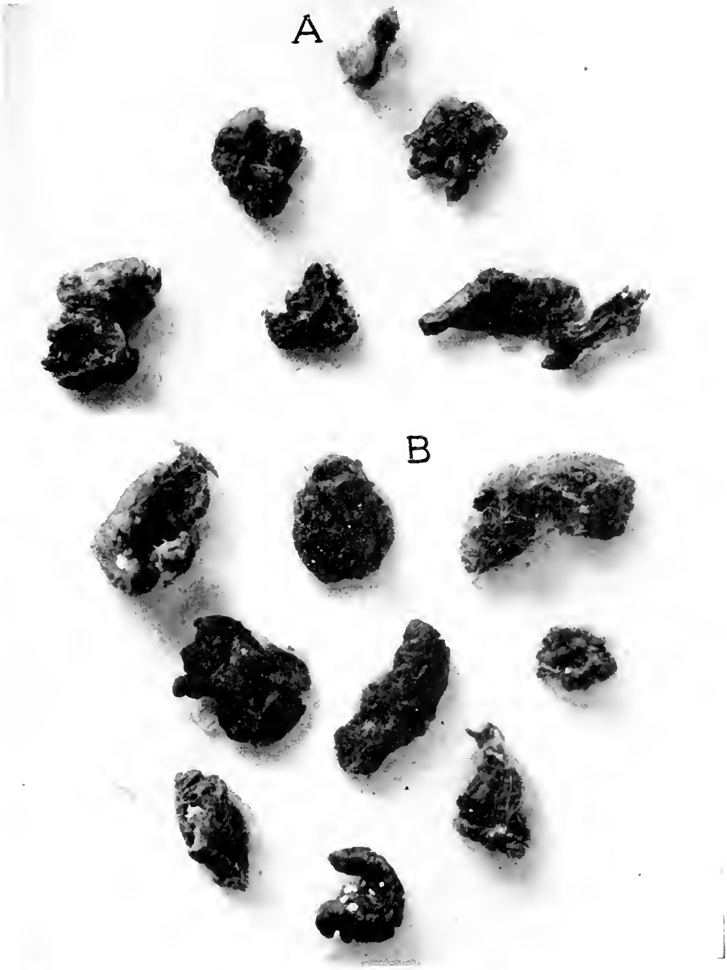
It is often not an easy matter for one to tell just when there is wax in the ears, for it may be present in a considerable quantity for a long time without causing any symptoms whatever. The trouble may be referred to some other part of the head or body, wax in the ear not being suspected as its cause. A weakening circulation from old age, or some heart trouble, or disturbance of the digestive tract, may be given as the origin of trouble in the head which may be caused simply by the presence of wax in the ears, its removal giving prompt relief.

Anything interfering with the discharge of wax from the ear of course leads to an accumulation of the secretion in the meatus. The size and density of the mass will vary according to the activity of the secreting process, the anatomical formation of the canal, and the length of time the obstruction has existed. The whole canal from the tympanic membrane to the opening may be filled with a more or less tough wax, firmly embedded; the accumulation may be adherent to the membrane in every part as a plastered mass spread over it, or it may exist as a mass in the canal of harder or softer consistency.

There are many points to be taken into consideration in connection with the presence of wax in the ears, such as its consistency, size, form, color, situation, attachments, etc. It may be black, brown, whitish, or yellow, according to the length of time it has been in the meatus, although it may become mixed with material from without, such as dust, cinders, etc., and with discharges of blood, pus, or mucus within. Normally, however, it seems to change from yellow to brown, and from brown to black, as the consistency varies from a semi-liquid to that of a firmer mass, and then to a hard, dense formation. It may be lying along the canal as a soft liquid substance, gradually eking its way out to the opening in a small stream, or it may be hard and dense, in one or several pieces, and almost incompressible.

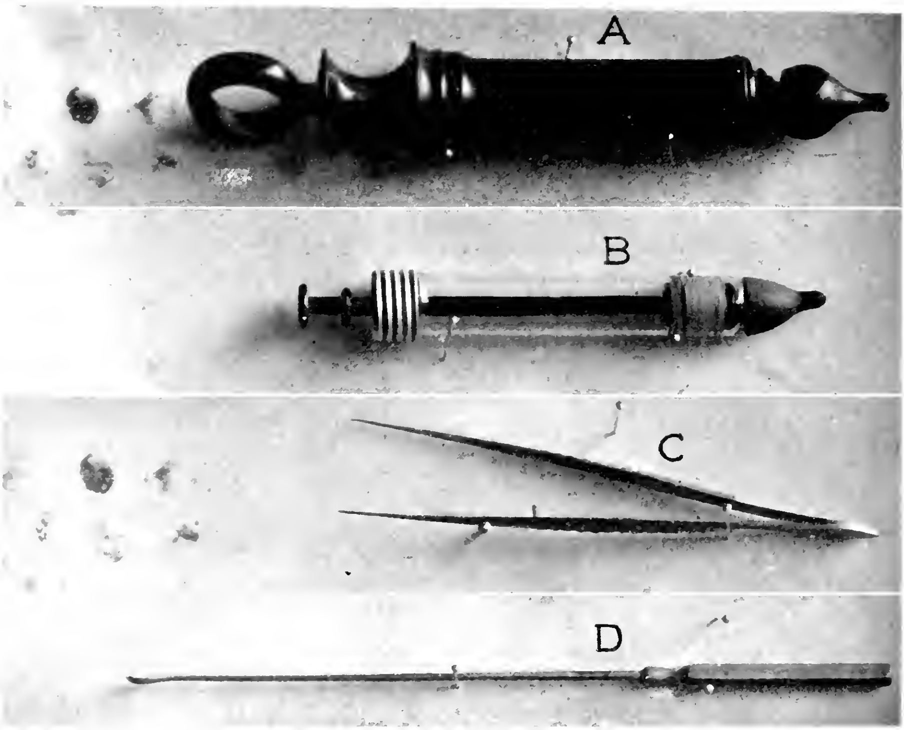
The form wax may take varies a good deal, from small, irregular specks or flakes up to larger irregular pieces or chunks, singly or as several pieces joined together. Some pieces may be long, and somewhat round, and other pieces may be short, round, and narrow, being to some extent moulded by the canal. Again the pieces may be irregular, thin and flat, while others are flat and thicker, so that all shapes and sizes may be found. (Fig. 1.)

Fig. 1.



Wax removed from two patients (*A* and *B*).

Fig. 2.



Instruments used in the removal of wax from the ear. *A* and *B*, Syringes. *C*, Forceps. *D*, Probe.

The situation of a piece of wax does not seem to be confined to any one place in particular in the canal, but it may be found on any of the walls from the entrance to the tympanic membrane, and on any part of the latter, or covering the whole of it. In some instances it may be so firmly attached to the tympanic membrane that it can be removed only with great difficulty, sometimes causing hemorrhage in doing so, and the same is true of pieces adherent in the canal. In some cases perforations in the membrane occur from long adherence of the wax, which may destroy it in part or altogether so that it may entirely disappear in time.

Fleshy patients of sanguine temperament, or the phlegmatic type, full eaters with greasy skin and sluggish bodily habits, are perhaps more likely to have wax accumulate in their ears than others. Those of a nervous temperament are more likely to have less wax in their ears, but more dry, flaky pieces, which seem to be formed from this very condition. It may be stated, however, that at times a condition of dryness may alternate with one of a moist secretion, while the mere drinking of a certain amount of water will often be sufficient to relieve states of dryness, so that a moist condition of the canal or the gradual formation of wax can hardly be called a restorative of nature, as some might think.

When wax has collected in the ear in any amount, it does not seem to serve any other purpose than that of waiting to be removed, but in the meantime it might do some harm, so it is safer to have it got out of the way and the parts relieved from the possibility of irritation. The symptoms depend a good deal upon the position of the mass, its consistency, size, and the length of time it has been in the canal. Small even and rather large pieces may remain in the canal for a long time and cause no trouble or impairment in the hearing; a small mass, however, may be so situated as to cause prominent symptoms. The whole canal may be filled from the opening to the tympanic membrane, with some adherence to the latter, for some time without causing deafness or other symptoms. The presence of cerumen in the ear does not necessarily cause noises in the head, especially if in small pieces and not impacted or adherent. Where there is firm adherence of wax to the tympanic membrane for any length of time, or impaction of a mass against it, then it is likely to produce deafness in some degree, along with fulness in the ear, ring-

ing and buzzing sounds, neuralgia in the temporal region, cough, fainting and dizziness, and sometimes perforation. A foreign body may get in the ear and wax accumulate about it, and in time cause more marked symptoms. But this depends upon what the object is, its size and position, etc.

Out of a certain number of cases examined by McNaughton Jones, of London, England, one-seventh of the number had wax in their ears; and again, out of 2543 cases it was found in 338. In the right ear of patients he found cerumen in 295 cases. Wax may often be found in one ear and not in the other, due to catarrhal conditions of the nose and nasopharynx affecting one side more than the other, possibly.

The diagnosis is often not easy, unless there is something in particular which may draw attention to the part, so that the presence of wax in the ear may sometimes be overlooked. Head symptoms caused from trouble in the ear produced by wax, as inflammation and erosion of parts of the tympanic membrane, for some time may be referred to any other part of the body but the ear. There may be a feeling as if something was in the ear all the time, while a slight ringing may be present occasionally, along with a little deafness. An examination of the ear may show some wax at the entrance, or the use of the otoscope may discover some much farther in. If no wax is found near the opening, then gently syringing the ear with warm water a few times may remove some of it, if there is any present. The prognosis is not serious unless there is inflammation, ulceration, or perforation of the tympanic membrane, or the presence of pus.

The mode of treatment depends a good deal upon the amount of wax in the ear, its size, position and adherence, as to whether the canal is completely filled or not, or whether only small pieces are present and adherent or not, either to the tympanic membrane or to the walls of the canal. In every case, however, there is only one thing to be done, viz., to remove it in as gentle a manner as possible in order not to injure the parts or cause pain to the patient, for the ear is a sensitive organ, and much more so when irritated or inflamed. If the wax is impinging around the edge of the tympanic membrane or covers any part of its surface, it should of course be removed at once, especially if it has been present any length of time, for it is

likely to become firmly embedded and in time cause ulceration of the membrane and perforation, also deafness.

The method to be used in removing the wax depends a good deal upon the skill of the surgeon, for the method one has found very serviceable may not perhaps appeal to another. If the canal is completely filled with wax, as occurs in some cases, it is best to remove as much of it as possible with a suitable pair of forceps or a scoop, doing so gently and using more care as the tympanic membrane is approached. Wax impacted around the membrane or over its surface should, of course, only be removed by a skilled manipulator. This may be done by first syringing the ear with warm water to soften and loosen the wax; then a small piece of cotton on a probe may be used to push it off the surface of the membrane to one side, or to remove some of it; then a fine-pointed pair of forceps may be used to remove it. Instead of using the end of a match or head of a pin to scratch the parts at the entrance to the meatus, it is better to put the end of the small finger in the ear; then if the mouth is kept open and the head turned to one side, while the end of the finger is moved quickly about in the ear, any itching may be relieved for a time, while particles of dry cerumen will come away. (Fig. 2.)

A solution that can be used at any time for washing the ear out is bicarbonate of soda, 15 drachms; glycerine, 2 drachms; water, to 1 ounce. Or the bicarbonate of soda may be put in half a glass of water and the solution injected into the ear at once; or boracic acid, which is usually on hand, may be used in the same way. A solution of liquor potassii, or olive oil, or glycerine, to soften the wax, is also used. Some depend entirely upon the use of warm water to remove wax from the ears, using a suitable syringe of vulcanite or glass with a short rounded tip so as not to injure the ear nor go too far into the canal.

Where the canal is filled with wax it is better to use a small scoop to remove some of it first and to syringe it out with warm water afterward. For small pieces anywhere in the canal syringing is useful, but the stream should always be directed against the sides of the canal to break its force so as not to injure the tympanic membrane.

Eugenics

THE SCIENCE AND PRACTICE OF EUGENICS OR RACE-CULTURE

BY MEYER SOLOMON, M.D.
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(Concluded from March issue)

7. *Is Mankind Advancing?*

Is it inevitable that our civilizations, our nations, our empires, like those which have gone before us, must die? Is our civilization any higher than those which have preceded us? Is mankind advancing? To answer the first question, we must first know why past nations rose and fell. At first there waged a struggle of man against man, tribe against tribe, nation against nation. The fitter or fittest were selected for parenthood. The tribe with the fitter individuals overcame the tribe with the less fit. And so it was also with nations. Here and there in the past arose great nations, like the Babylonian and the Greek, whose civilization was high. Each civilization had its great minds, intellects, and geniuses. The importance of eugenics was most generally not understood. There were those who, like Plato, did realize it. Others, like Epictetus and Marcus Aurelius, preached the brotherhood of man. Art, literature, sculpture, and architecture flourished. Civilization was indeed high. The contest, the struggle for existence lessened. Luxury, vice, dissipation increased and flourished. It attacked the good as well as the bad. The unfit element became more and more fit for the lessened struggle for self-preservation and propagated their kind in ever-increasing numbers. The total efficiency of the nation became lower and lower. The empires, the nations, had risen, reached their supremacy, and now declined because the selection for parenthood was not realized. So civilizations, empires, nations rose and fell with intervening periods of stagnation. This is the eugenic explanation of racial decadence. Now we have a new civilization, just emerging from the dark ages. What is to be expected? Must each great nation die—degenerate?

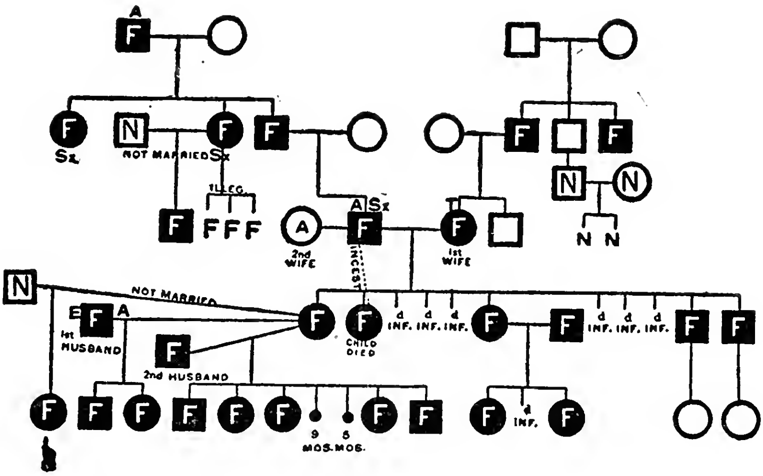
The English are much concerned just now about the possibility of national decadence. There is a fear that the degenerate and unfit element will rapidly increase, the better element decrease, and, especially if there be intermarriage of the fit with the unfit, which fortunately is uncommon, for like tends to mate with like, the English nation may easily degenerate. In England there really does seem cause for alarm, although the nation is surely not going so rapidly in its downward course as some seem to think.

Our country is still in a stage of development. It has not yet reached its supremacy. But can we take steps now to prevent or long delay a similar fate?

Now as to the last two questions which we asked ourselves. Is our civilization any higher than those which have gone before us? Is mankind advancing? Is it more worth while living?

We find our answer in the results to humanity of the increasing knowledge of the sciences. We cannot here enter into a discussion of the specific results springing from increased knowledge, on the one hand, of the natural sciences which deal with environment, or, on the other hand, of the biological sciences which deal with individual life. But, speaking of general results, we may say that science expands the mental horizon, leading to broader conceptions and

Fig. 5.



Family history illustrating heredity of feeble-mindedness. (After Goddard[21].) The symbols used by Goddard in his charts are the following: Square indicates male; circle indicates female. A capital letter indicates disease, habit, or condition, as follows: *A*, alcoholic (habitual drunkard); *B*, blind; *C*, criminal; *D*, deaf; *Dwf*, dwarf; *E*, epileptic; *F*, feeble-minded, either black letter or white letter on black background (the former when sex is unknown); *I*, insane; *M*, migraine; *N*, normal; *Sx*, grave sexual offender; *Sy*, syphilitic; *T*, tuberculosis; *W*, wanderer, tramp, or truant. Any of these letters may be used with no square when sex is unknown. When even the letter is omitted the vertical line indicates that there was an individual of whom nothing is known. Small black circle indicates miscarriage—time is given (in months) when known, also cause; still-birth is shown as a miscarriage at nine months; *b* = born; *d* = died; *m* = married; *inf.* = infancy; hand shows which child is in the institution for feeble-minded; *illeg.* = illegitimate; heavy line under any symbol indicates that the person is in some institution at the expense of society. On the lower line, which represents the brothers and sisters of the child in the institution (The Training School, Vineland, N. J.), the children are indicated in the order of birth—the oldest to the left. In other cases the order would be indicated, if known, by numerals above the horizonal line.

more active mental life; it gives an understanding of law, of true cause and effect, thus developing man's mind, directing his conduct according to reason and not superstition, and making him look to the future; it restrains and directs the emotional life, especially the passions, so that reason and not passion is the guide of actions, gives increased power of discrimination and greater self-control, toleration, and broad-mindedness, and causes man to consider results, to have impulse supplemented by reason, and to economize time and strength in the pursuit of useful activities; and, lastly, science is the basis of art, and its progress has stimulated and perfected the useful arts. In brief, we may say that science gives an explanation of the universe and of man's

place in nature, based on intelligence and reason instead of emotions alone, while at the same time fully developing broad-minded sympathy which finds its outlet in medicine, charity, etc.[18]

The world to-day may not have intellects or genuises as great as or greater than those of past civilizations, but in the average, in the spread of education, of increasing betterment of environment or ease of living, and in sympathy and altruism, mankind has most certainly advanced.

Yes, it is more worth while living to-day than a thousand years ago. All knowledge is now on a more sound basis and has increased in every direction. Why, a school-boy may know more than Aristotle! But is this because he has had greater opportunity for gaining knowledge or is it because his inherent mental qualities are greater? This brings us to the battle-field of biology and of eugenics—the relation of heredity to environment.

8. *Relation of Heredity to Environment*

From a study of the influence of parental habits, of parental employment, of parental wages, of the nature of the home and of the manner of life and occupation of the children on their physical and mental qualities, Pearson[19] concludes that, on the average, the effect of nurture is hardly one-fifth to one-tenth that of heredity.

To me the part attributed to environment by Pearson seems much too small. The question is not which is greater or more important. Both are essential. Altering either will alter the resulting state of interaction between the organism and the environment. What we want to understand is just what their true relation is, what part heredity plays and what can be expected of environment.

An individual's character is the result of heredity and environment. By heredity he has certain potentialities. Environment, nurture, education, and training are the means of drawing out these potentialities. Heredity can do nothing without the influence of environment. And environmental conditions shape and modify hereditary or inborn tendencies. They may, within certain limits, suppress some and encourage others. But they cannot bring out or make appear what is not potentially existent within the germ-cells. As mentioned earlier in this paper, heredity is merely the general resemblance between parents and offspring, and by virtue of heredity we possess in most cases potentialities only of a general nature or the tendency to follow certain general lines of development, the particular form which this finally assumes depending on the stimulating effects of environment. At times, also, there may even be an inborn tendency to develop along certain more definite paths. An illustration, mentioned previously, is the family tendency toward general mental or physical unsoundness or soundness, or, in some cases, the tendency to exhibit the same trait—such as maniac-depressive insanity or epilepsy.

Our characters are really the products of heredity and environment and not the sum thereof. It is not heredity plus environment, but heredity times environment, which makes us what we are. This is certainly most constructively conservative; for, if heredity is poor, good environment may make as much of it as poor environment can make of good heredity. Nature can in great measure replace bad birth, and bad nurture can destroy the advantages of

good birth. But, under the same conditions of environment, good heredity will yield better results than bad heredity. We know only too well that, given two children born equally well, of the same parents, with exactly similar home influences, going to school together, having the very same teachers, using the same books and receiving home and school training similar in every respect, we most certainly would not expect to find them exactly alike.

The racial poisons apart, no matter how education and nurture may modify heredity, these acquired modifications are not transmitted. The germ-plasma remains unaffected in any way. Each generation begins where the other began; the children must relearn what the parents had to learn. Each generation gets a fresh start.

What, then, is the value of education to the race? Simply this: that good education can make the best of environment, drawing out the best that is in the child and suppressing the bad. It can make the most of heredity or greatly frustate it. Each generation advances further than the one which preceded it.

It is claimed that the load of tradition, the knowledge, etc., which it is necessary for one to acquire in these days to be fit for the struggle for life is so great that unless our inherent qualities or potentialities are strengthened by proper matings we are building an inverted pyramid, and the superstructure will become so top-heavy that there will be a collapse. The nation will deteriorate. It is just this which is said to be the cause of the great increase in mental defects and disorders of all sorts. The struggle is now in the realm of the mind. It is a mental combat. Therefore, strengthen heredity by mating fit with fit. Is our civilization mainly an acquired evolution which is of no permanent value to the race? Bettered environment and improved education do not create new germinal types. They do not necessarily mean progressive evolution. Has the time now arrived when we must combine with natural selection conscious reproductive selection, in order that we may obtain a true, germinal, inherent, racial evolution?

Now, although there is no hereditary transmission of acquired characters, functional or modificational, the germ-cell and developing fœtus may be affected by racial poisons circulating through the system. These racial poisons may produce developmental modifications, generally in the line of deformed or defective development. And these conditions show themselves in the bodies of the next generation. Remember, however, that such changes are due to direct action on the germ-cells and not by modifications in the somatic cells. These so-called racial poisons include bacteræmias (as in the case of the plasmodium malariæ, the spirochæta pallida, etc.), toxæmias (like diphtheria, typhoid, etc.), intoxications (like lead and arsenic poisoning and very probably alcohol), and disturbed metabolic states (tuberculosis, diabetes, or constitutional disease of any sort).

Chief among these racial poisons is syphilis. As the spirochæta itself frequently invades the developing embryo, it becomes directly hereditary. In fact, syphilis is the only disease which can be transmitted to offspring in full virulence. In other instances syphilis, like all other toxæmias or disturbed metabolic states, may produce perverted development or underdevelopment which expresses itself as a general constitutional defect, physical or mental, or both.

The exact racial effects of alcohol are still not positively determined. Inherited bodily or mental disease as a direct result of its misuse is not definitely

established. Weakened, epileptic, or feeble-minded offspring, insanity, etc., are frequently associated with, but not necessarily the result of, alcoholic excess in the parents. They may be due to the same underlying defect. Whatever the primary origin of the habit, hereditary or acquired, I can see no reason why alcohol cannot produce the same results as lead or malaria. That one is a fluid and the other a metal or an organism should not alter its respective poisonous action.

In the case of all racial poisons the effects are most marked when affecting both parents, less so if occurring in the female alone, and least if in the male alone. But occurring in woman, especially during pregnancy, the results are of the utmost importance.

When we come to the question of immunity, we face a still more difficult problem. Acquired immunity may be transmitted to the offspring. But immunity of the father produces no effect on the offspring. Immunity of the offspring is produced only by immunity in the mother. It is the production of antibodies in the offspring of the mother which produces this immunity, which, like many diseases referred to when discussing racial poisons, can be transmitted from the mother to the fœtus. Yet vaccination, although continued for many generations, has not yet produced immunity in the race. So also with diphtheria. "Immune mother, *but not immune father*, will produce immune children."[18] And this immunity is only temporary. If the offspring of successive generations were not attacked by diphtheria, this temporary immunity would soon disappear. Because the mother had diphtheria, the son or daughter is not forever immune.

It is not difficult to see how if successive generations are affected by the same states of bacteræmia, toxæmia, and intoxication, since a certain immunity already exists in the offspring, there is a constant addition to the degree of immunity, so that there is a relatively increasing immunity, both in degree and permanency, in successive generations. Consequently the race most immune to the effects of malaria, or alcohol, or syphilis, or what-not, is the one whose ancestors have suffered from it most, in which the weakest have been eliminated, and in whose blood there now exists the highest degree of immunity. Does this mean the transmission of acquired traits by cumulative effects?

This is a question which calls for further investigation. The heredity of immunity and insusceptibility is one of the most important fields of eugenics. It is of extreme interest to the student of heredity, of medicine, and of eugenics, because, although it seems to follow certain more or less definite hereditary tendencies in other animals, but has not been so proven in man, still it has without doubt been a very important factor in the evolution of man and in the history of his civilization and conquest.

In conclusion, I need do no more than refer to the marked results of diseases of the pelvis, uterus, and adnexa upon the germ-cells or the developing fœtus. Such changes are due to direct inflammatory action or to nutritional disturbances.

A consideration of the facts here presented shows us at once that the line of distinction between heredity and environment is not nearly so sharp as some writers are wont to make it. Here, too, as in all nature, we find a borderland region where they merge into each other. Extremes are decidedly noticeable. But in the average case, where the deviation from the mean is slight, we find

ourselves in a borderland area where we cannot with certainty say just what or how much is due to heredity and how much to environment.

III. THE PRACTICE OF EUGENICS

Up to this point our attention has been directed to the science of eugenics. Having considered the scientific foundations, what can we expect in the way of practical eugenics? We must not forget that the highest function of science is to be of practical value to mankind. That ultimately is the object of all science.

Our attention was called earlier in this paper to the eugenic explanation of the rise and fall of past nations and civilizations. We also devoted some space to a consideration of the question of present indications of national decadence. And, in answering the question, "Is mankind advancing?" we mentioned the beneficent effects of increasing knowledge of the sciences.

We must now discuss some of the undesirable effects of medicine, the relation between fluctuations in the constitution of a nation and its progress or retrogression, and the direction of future social improvement. Practical eugenics has to deal with the possibilities of enforcing conduct by social or legal sanctions.

a. THE NEED OF PRACTICAL EUGENICS

The natural sciences have enabled us to solve many of the problems of environment, while the biological sciences have been of equal help to us in our attempts to solve the problems of individual life. The advance of the natural and biological sciences has made possible greater and greater control over nature and, as a direct result, increased wealth. But, along with the many advantages thus gained, we note some evils which have crept into modern society. These evil effects are dependent on two main causes—the irrational propagation of human beings and the unrestrained production of wealth.

This unrestrained production of wealth has resulted in a divergence of classes which seems entirely out of harmony with the modern trend of development. Certain classes have amassed wealth. Other classes are burdened because of poverty and its disadvantages. The successive generations have in turn fallen heir to the disadvantages and advantages associated with the financial status of the family, so that these results have in a way been cumulative. As a natural consequence society suffers because so many of her good citizens lack opportunity. As the poet so sweetly says,

"Full many a gem of purest ray serene
The dark, unfathomed caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air."

It is just this state of affairs, this inequality of the different parts of society, which has recently led one of our younger poets bitterly and eloquently to lift up her voice in protest, and warningly cry out:

"The unfit die; the fit both live and thrive!
Alas, who say so? They who do survive.

So, when her bonfires lighted hill and plain,
Did Bloody Mary think of Lady Jane.

So Russia thinks of Finland, while her heel
Falls heavier on the prostrate Commonweal.

So Booth of Lincoln thought; and so the High
Priests let Barabbas live, and Jesus die."

And along with this divergence of social classes and the lack of opportunity for many very fit and worthy citizens we have been witnessing the introduction and the spread of another great evil, a true disease of society: the production of an increased number of defectives, delinquents, and dependents, with the lowering of the vitality of the population resulting therefrom. These incompetents, many of whom are decidedly anti-social, are supported partially or wholly by the competent, upon whose shoulders this burden necessarily falls.

We are face to face with two very serious problems which, instead of being self-corrective, will probably go on increasing, unless they are corrected by new forces wielded by man to control and direct progress and evolution. The new forces which must be developed are the social sciences. Knowledge of the natural and biological sciences has not prevented social disease from flourishing. The problems of environment will be solved by the natural sciences, the problems of individual life by the biological sciences, and the problems of society by the social sciences. These social sciences, which are the weapons of eugenics, seek as their object the elimination of those who prey upon society and the gradual smoothing-out of the relations of the rest.

Medicine has been severely criticised for being responsible for interference with the free play of natural selection and the consequent survival of great numbers of unfit. True, some evil may have found its way into society together with the good. But the remedy will not be found by returning to nature's old method. Mankind has advanced, and one of the greatest steps in this advance was the development of a broadening sympathy and altruism which, unwilling to have man remain forever a helpless witness in nature's murderous slaughtering house, found its means of correction in the development of medicine. But environment, customs, and ideals of societies change constantly. We have a changed state presented to us by society to-day. Our attitude toward these changing social relations and conditions of life must likewise be changed. Modern sentiment must not and will not permit the continuance of this indiscriminate production of the unfit, who are soon eliminated in the struggle because they cannot adapt themselves or measure up to the demands of modern civilization. What is our remedy?

"The average of a whole social group can be shifted by subtraction at one end or addition at the other, or more easily and more effectively by both together." And then again, says Kellicott,[10] "elevation from mediocrity to superiority has far greater effect upon the social constitution than has elevation from inferiority to mediocrity." This shows us how a nation may advance or recede.

Can we hasten progress in man by consciously and intelligently improving the inherent qualities of the race? In the case of the fungoid disease "rust," to which some kinds of wheat are very susceptible and others immune, the disease "rust" has been proven to definitely mendelize; and by the practical application of this simple discovery forms of wheat can now be produced forever immune from "rust." What can be done in the way of practical application to the diseases of society?

b. PROPOSALS FOR PRACTICAL EUGENICS

Practical eugenics presents two phases—positive and negative, or, better, constructive and restrictive.

Positive or constructive eugenics encourages parenthood of the most desirable, while negative or restrictive eugencies discourages parenthood of the least desirable.

1. *The Ideal of Eugenics*

The best results can, of course, be obtained by a strict practice of both. And it is this which is the ultimate ideal of eugenics. Sir Francis Galton[2] has put this so finely that I must quote him at length:

"I take eugenics very seriously, feeling that its principles ought to become one of the dominant motives in a civilized nation, much as if they were one of its religious tenets. . . . Man is gifted with pity and other kindly feelings; he has also the power of preventing many kinds of suffering. I conceive it to fall well within his province to replace Natural Selection by other processes that are more merciful and not less effective. This is precisely the aim of Eugenics. Its first object is to check the birth-rate of the unfit instead of allowing them to come into being, though doomed in large numbers to perish prematurely. The second object is the improvement of the race by furthering the productivity of the fit by early marriage and the healthful rearing of their children. Natural Selection rests upon excessive production and wholesale destruction; Eugenics, on bringing no more individuals into the world than can be properly cared for, and those only of the best stock."

The aim of eugenics, says Galton, is to "represent each class . . . by its best specimens; that done, to leave them to work out their common civilization in their own way."

2. *What Eugenics Does Not Mean*

As with all new ideas which may be blessings in disguise, the real aims and objects of eugenics are much misunderstood.

Eugenics is not a cure-all. No single remedy is. Nor will it lead to Utopia or the eradication of all evils. But it is the most important single factor for racial improvement—for the upbuilding of a stable, permanent, and more happy society.

It does not have as its object the production of a uniform single type of man. This is impossible, owing to variation. Such a state of affairs would mean the arrest of all progress, since organic evolution depends upon the struggle between individuals of various variations with the selection of those variations best fitted to the environment. Variation is essential to give fulness to life. No particular type is ideal. It takes all kinds to make a world. We do not intend to interfere with types so long as their activities are not antisocial.

It does not mean the production or the creation of genius or talent at will. What it does mean is the giving of more opportunity so that genius or talent may not be destroyed by environment.

It does not mean loveless marriages. We are told that human nature would positively never permit any interference with the freedom of marriage. Yes,

it almost seems foolish to even attempt to direct the course of love. But have we not amongst us to-day a multitude of marriage restrictions of all sorts, based on religion, race, social position, financial status, consanguinity, etc.? We have for generations been brought up to respect them, they seem to us quite natural, proper, and just, and we are not even aware of their existence. See how monogamy has been burnt into the conscience of civilized nations!

Eugenics does not mean to do away with sympathy for your fellow-being and the brotherhood of man. It springs from these very sources. It desires to prevent unnecessary and cruel elimination of those members of society who we know are born to only live to die.

The practice of eugenics is not opposed to religion, but eugenists wish to make it a part of religion—the religion of the future.

We do not propose to experiment on man or to breed for qualities. But we wish to learn our lessons from man's blunders and nature's experiments upon him.

Nor does eugenics wish to deny the poor the privilege of marriage and parenthood. What we wish to do is to upset the prevalent idea that anybody is good enough to marry; to teach the responsibilities of marriage and parenthood so that intelligence and reason may guide our passions and emotions. We wish to better the social life, correct economic conditions, and give increased opportunity.

It is not our purpose to return to nature's old method of unrestrained natural selection, but to correct many of the evils which have followed upon the suspension of natural selection; evils which are most certainly not self-corrective, but cumulative.

It is not our intention to produce a pessimistic, unhealthy view of life by pointing out the prevalence and widespread evil effects of disease, crime, and degeneracy, but, by pointing out what is positively bad, the difficulty or impossibility of cure by our present methods and the need for the new forces indicated by eugenics to instil a more optimistic, healthful view of life by leading the way to what is best for our general well-being—physical, mental, and moral.

When the scope and aims of eugenics are once clearly understood and fully appreciated, it will quickly be recognized by religion, custom, and law.

To me the two most sensible and practicable propositions with which we have to deal are: (1) lowering the number of defectives, delinquents, and dependents; and (2) improving educational and environmental advantages of the whole population. The first belongs to the domain of restrictive eugenics, the second to constructive eugenics.

3. *Negative or Restrictive Eugenics*

I pointed out earlier in this paper that "unfitness" in the eugenic sense means social unfitness or incompetence to a degree which precludes from parenthood the individuals thus afflicted. Huxley is reported to have said that the attitude to be taken toward these unfortunate unfit should be along these lines: "We are sorry for you, we will do our best for you (and in so doing we elevate ourselves, since mercy blesses him that gives and him that takes), but we deny you the right to parenthood. You may live, but you must not propagate."

The individual is certainly not to be blamed for his hereditary constitution, but for the protection of society we should do our utmost to prevent him from further propagating his kind—in other words, to asexualize him.

Now asexualization, which has as its object the prevention of propagation, may be accomplished by sterilization, segregation, mechanical methods for the prevention of conception, and, to a limited extent, by the legal requirement of a complete medical examination, physical and mental, before the issuance of marriage licenses.

Prevention of conception by mechanical means is entirely voluntary and therefore educational. Legislation is here of no value.

Medical examination as a legal requirement preliminary to the issuance of a marriage license would undoubtedly prevent a certain proportion of unfit marriages, but we know only too well that marriage, especially in the irresponsible feeble-minded, is no bar to intimate sexual relations with resulting offspring. Moreover, popular opinion does not yet seem ripe for the enactment of such laws, which must be preceded by legal action of some sort in the case of those members of society whom we know to be positively hereditarily defective as well as delinquent and dependent. Already laws prohibiting the marriage of defectives have been enacted in Connecticut, Delaware, Indiana, Kansas, Michigan, Minnesota, New Jersey, and North Dakota.

It now remains for us to consider asexualization by sterilization and segregation.

By sterilization the individual is at once completely asexualized so that he may be permitted the greatest possible liberty and freedom; he can go forth and take his place in society, and exercise his sexual function, but he is forever prevented from propagating his kind.

There are two* possible methods of sterilization: (1) by the X-ray, which is expensive, requires repeated treatments, is temporary and uncertain; and (2) by the operation of vasectomy in men and oöphorectomy in women. Vasectomy or oöphorectomy is the only true method of sterilization, being simplest, most effective, most permanent, and resulting in no deformity or serious physical defects.

Vasectomy [20] consists in merely cutting the vas deferens just before it meets the epididymis and ligating the abdominal but not the testicular end. The proximal end thus remaining patent, the testicular secretion flows freely from it, is absorbed, and carried through the system. All possible ill-effects which might result from its absence in the body are in this way avoided. Vasectomy is a short, simple, office operation, requiring only a few minutes to make a small incision in the scrotum over the site of the epididymis, drawing out the vas, cutting it with scissors, tying the distal end, placing the cut surfaces back within the scrotal bag, and stitching up the small skin incision.

Oöphorectomy is more difficult of performance, requiring abdominal or vaginal incision. The fallopian tube is subjected to treatment similar to that of the vas deferens in vasectomy. It is cut in its outer portion, and the inner end is ligated. The patent outer end permits absorption of the ovarian secretion. In women, with the permission of adults or the consent of the guardian, this operation may also be performed, especially in the course of an abdominal operation, for the prevention of pregnancy in cases of disease of the ovaries, tubes, uterus, or pelvis in general, where impregnation most certainly means

* Castration is not considered here, since vasectomy has superseded or should supersede that method.

death for the fœtus, and great suffering or even possible death for the mother. Some advocate complete removal of the fallopian tube by excision.

Segregation consists in the maintenance of separate institutions or colonies for men and women where, during the reproductive period, they may be confined, thus cutting off propagation of their kind and at the same time permitting them to earn a part of their own support by assigning to them some simple but profitable means of employment.

It is claimed that if left to a jury of laymen it would be no easy matter to convince them of the necessity for life-segregation, unless sterilized, of feeble-minded, especially if they had not been guilty of any grave moral or social breach prior to admission. Moreover, it would be very difficult to manage such a colony if the inmates knew there was no hope of release. They would consider it a prison and not a hospital.

Admitting the justice of these objections to compulsory segregation, yet, in cases where compulsory sterilization is justifiable, it seems to me to be the only method in accordance with modern sentiment, custom, and law.

Here, then, we have two methods of asexualization proposed for eugenic practice. But in what classes shall compulsory sterilization and segregation be enforced by the State?

Sterilization is being discussed in England, France, Germany, and Switzerland, but little action has been taken outside of America. Sterilization bills have been introduced by the legislatures of a number of States but not yet passed, except in Ontario (Canada) and in the States of Indiana, California, Connecticut, and only lately, in March, 1911, I glean from the newspapers, in Iowa.

The law of Indiana (March, 1907) includes confirmed criminals and rapists, idiots, and imbeciles. Vasectomy is not specified, and there is no mention made of penalty against those who sterilize degenerates without official sanction.

The law in California includes those guilty of sexual offences, and moral and sexual perverts. No special operative procedure is authorized, and it is not made an offence to operate without authority to prevent impregnation and conception.

In Connecticut, by an act in August, 1909, oöphorectomy and vasectomy are specified, and it is made a penal offence to perform such operation except as a medical necessity, unless authorized by the act.

In each State justifiability of the operation is decided upon by a board or committee of experts, following a thorough examination, physical and mental, of each case.

There is nothing said in any of these acts concerning the sterilization of degenerates at their own or their guardian's request.

I have as yet not been able to obtain the laws enacted in Ontario, Canada, and so recently in Iowa.

There are some radical eugenists, who, carried away by an overpowering enthusiasm, demand sterilization of the idiot, the imbecile, the epileptic, the chronic insane, the confirmed criminal, the inebriate, the pauper, and the moral pervert. Such extreme measures are, to say the least, unwarranted in the light of present knowledge.

Negative or restrictive eugenic practice by sterilization can be limited only to those positively hereditarily degenerate or unfit. It is they who are the

burden of the fit and worthy citizens of society, and who in great numbers go to form a great proportion of our dependent, defective, and delinquent population. We cannot advocate sterilization of such individuals other than those who are absolutely unfit and whose unfitness has been received by heredity and will certainly be transmitted to posterity. In a word, the object of negative eugenics is to prevent hereditary disease of mind and body. All eugenic practice must be guided by scientific knowledge, and the only true argument in favor of sterilization in any case can find its support only by proof of the Mendelizing character of the unfitness and in the Mendelian law of gametic segregation. This must be positively and thoroughly proven in each particular case. Although hæmophilia, Huntington's chorea, and such conditions are to be thought of in this connection, they are of only minor importance. The most serious problem which confronts us here is the care of the feeble-minded, imbecile, and epileptic. It is they who concern us most, for they are morally weak, irresponsible, degenerate, and propagate most abundantly. Feeble-mindedness, imbecility, and idiocy are but varying grades of arrested development, and may all be classed under feeble-mindedness. An unrestrained, feeble-minded woman is decidedly anti-social. These mental defectives go to form a more or less large portion of the occupants of our almshouses, orphan asylums, deaf and blind institutions, institutions for juvenile delinquents, reformatories, jails, and prisons.

Davenport [17] tells us that, so far as he is aware, there is no case on record where two imbecile parents have produced a normal child. Imbecility seems to behave as a Mendelian unit.

True feeble-mindedness is absolutely incurable. Goddard [12] says that feeble-mindedness is hereditary in at least sixty-five per cent. of cases.

In a large number of cases the descendants of feeble-minded parents are epileptic, blind, deaf, paralyzed, alcoholic, pauper, criminal, prostitutes, or afflicted in some other way. Fig. 5, which is a pedigree chart showing heredity of feeble-mindedness, is most illuminating on this point.

The case presented here for social study is thus described by Goddard: [21] "Here we have a feeble-minded woman who has had three husbands (including one who was not her husband), and the result has been nothing but feeble-minded children. The story may be told as follows:

"This woman was a handsome girl, apparently having inherited some refinement from her mother, although her father was a feeble-minded, alcoholic brute. Somewhere about the age of seventeen or eighteen she went out to do housework in a family in one of the towns of this State (New Jersey). She soon became the mother of an illegitimate child. It was born in an almshouse to which she fled after she had been discharged from the home where she had been at work. After this, charitably disposed people tried to do what they could for her, giving her a home for herself and her child in return for the work which she could do. However, she soon appeared in the same condition. An effort was then made to discover the father of this second child, and when he was found to be a drunken, feeble-minded epileptic living in the neighborhood, in order to save the legitimacy of the child, her friends saw to it that a marriage ceremony took place. Later another feeble-minded child was born to them. Then the whole family secured a home with an unmarried farmer in the neighborhood. They lived there together until another child was forthcoming, which the husband refused to own. When finally the farmer acknowledged the child to be his,

the same good friends interfered, went into the courts and procured a divorce from the husband, and had the woman married to the father of the expected fourth child. This proved to be feeble-minded, and they have had four other feeble-minded children, making eight in all, born of this woman. There has also been one child still-born and one miscarriage.

"As will be seen from the chart, this woman had four feeble-minded brothers and sisters. These are all married and have children. The older of the two sisters had a child by her own father, when she was thirteen years old. The child died at about six years of age. This woman has since married. The two brothers have each at least one child of whose mental condition nothing is known. The other sister married a feeble-minded man and had three children. Two of these are feeble-minded and the other died in infancy. There were six other brothers and sisters that died in infancy."

Butler [22] declares feeble-mindedness produces more pauperism, degeneracy, and crime than any other one cause. I want to warn the radical eugenists that this does not mean that every criminal, every alcoholic, every prostitute, every insane individual is a degenerate. In a great many, perhaps even in the great majority of these cases, the defect is inherited. But we should not neglect the tremendous influence of environment. The "born criminal" type probably does exist; but not every criminal is a born degenerate. And is she who develops a psychogenetic depression of necessity of a degenerate type? Where is there the man or woman who will withstand all manner of nervous shock and strain, be it ever so great in degree, so prolonged in duration? The full influence of environment is only beginning to receive its full share of appreciation.

4. *Positive or Constructive Eugenics*

It is plain to see that restrictive measures such as compulsory asexualization by sterilization or segregation, or the passage of laws requiring medical examination as a prerequisite for the issuance of a marriage license, or the practice of voluntary restraint by the prevention of conception by artificial means, are stages which cannot be reached in a leap and bound. There cannot be a wholesale overturning of all past custom and sentiment in this matter, but we must have a skilful and gradual elimination of certain gross defects in our marriage laws and practices.

Nor can we expect to accomplish much by encouraging the fit to marry more frequently and at an earlier age than seems to be the custom among so many of them in these days. This is a purely personal equation. You cannot make a man or woman marry, less so at an early age, unless he or she be so inclined.

a. WORK THAT REMAINS TO BE DONE.—A campaign of education extending through all classes must precede further progress. Public opinion must be ripe and must be gained. Before we can expect anything in the way of practical eugenics we must have enlightenment of the public and the individual. The laws of heredity so far as they are surely known, and the general principles of eugenics must have widespread dissemination.

But we must not be too radical, too unreasonable, too previous in our recommendations, or too easily carried away by our enthusiasm and feelings, for this will but lead to certain disaster and failure. Like every science, eugenics, as pointed out by Pearson, must go through three chief stages of development—first, the ideological stage, with discussion of ideas or introspective philosophy;

next, the observational stage, with critical observation of phenomena, recording and describing; and, third, the metrical stage, which regulates the world of conceptions and is the aim of science. All these stages must be especially thorough in biology, and most decidedly so when applied to man, as in the interpretation of history and in eugenics.

And as Galton declares in his essay on "Eugenics: Its Definition, Scope and Aims,"[2] the science of eugenics must first be made familiar as an academic question. We must learn that "the proper study of mankind is man." It is our social problems which should become the great academic problems. The object of science, Pearson wisely says, should not be merely to learn facts and collect hypotheses, but to train and develop our minds to make us better citizens. When once the full importance of eugenics has been understood and accepted as fact, it will pass from this theoretical stage to the stage of practicability, and then, but not until then, can it be "introduced into the national conscience like a religion." But "the first and main point," Galton tells us, "is to secure the general intellectual acceptance of eugenics as a hopeful and most important study. Then let its principles work into the heart of the nation, who will gradually give practical effect to them in ways that we may not wholly see."

We must remember that at present race-culture is merely in its embryonic state—in its infancy. What we need now is more facts. Knowledge, belief, and action will follow in natural consequence. We must wait till the Mendelians and biometricians are in possession of more facts. When investigation, experimentation, and observation bring forth positive, definite proof of eugenic value, then will swiftly come the educational period with the spreading of this knowledge first among the more intellectual classes, soon to be followed by popular opinion, legislation, and finally real, voluntary eugenic practice. So it has been with all advances in medicine, public sanitation, and hygiene. And so it must be with eugenics.

And this collection of data must be extensive, exact, unbiased, and the result of purely scientific research. This research must extend into all possible aspects of the eugenic question, including the varied aspects of racial history and evolution, the net fertility of all classes, the racial effects of all sorts of environmental and occupational conditions, variability and variation in the human race, human heredity, of normal and pathological, physical and mental conditions and traits.[10] In this work the scientist needs must have the aid of institutions, charity organizations, and philanthropic associations of all sorts. The field-worker is an absolutely essential and most invaluable agent.

b. Work Now Being Done.—Already much work along this line is being done. In Germany and Switzerland there are excellent men working in this field. In England there is a quarterly publication devoted solely to eugenics and called *The Eugenics Review;* there is a national Eugenics Education Society with affiliated local societies; and there are the Biometric Laboratory and the Eugenics Laboratory, both of which issue many publications of a not too technical and therefore popular sort, and, by the will of the late Sir Francis Galton, a Chair of Eugenics has been created in the University of London, with Professor Karl Pearson at the head. In the United States the American Breeders' Association has organized a Eugenic Section, of which Dr. David Starr Jordan is president and Dr. C. B. Davenport secretary, with subcommittees, consisting of men of wide repute, on heredity of feeble-mindedness, insanity, epilepsy, criminality, and deafmutism,

the organization of still other committees being contemplated within the near future. The *American Breeders' Magazine,* a quarterly published by the American Breeders' Association, has become a magazine for eugenics and genetics as well as for breeders of animals and plants. At Cold Spring Harbor, Long Island, on October 1, 1910, The Eugenics Record Office was established in connection with the Eugenics Section of the American Breeders' Association. The aim of this office is to act as a clearing-house for data concerning "blood lines" and family traits in America. Dr. Davenport, of the Carnegie Institution of Washington, is one of the moving spirits in this work. The Eugenics Record Office is in communication with all the heads of all the institutions in the United States concerned with abnormal individuals, and invites collaboration and exchange of data. Several publications have already been issued, accurate methods of collecting, charting, and analyzing data for family pedigrees have been elaborated, classes are trained for the special duties of field-workers, and a number of trained field-workers are maintained throughout the country in special lines of research work in collecting pedigrees. Extensive records are being kept of all the valuable information received, and the office hopes soon to have co-operative field-workers appointed and maintained by every State institution. It is hoped in this way to produce convincing data, adequate for deduction of the laws of inheritance and of true value for scientific studies preliminary to legislation for the prevention of the production of defectives. The movement has made tremendous progress in a very short period of time, and the total final results cannot be foretold. I look forward with great expectation to the meeting of the First International Eugenics Congress, to be held in London from July 24 to 30, 1912, under the direction of the Eugenics Education Society.

c. Educational Reformation in Order.—All this is very inspiring and indicative of valuable results. But in the matter of eugenics should we deal only with heredity? Eugenics has to deal not only with the problems of environment but also with the problems of nurture and environment. Remember that eugenics means both well-born and well-bred. I fear there are some ardent eugenists who have lost sight of this. Hearken unto the wise words of the very founder of eugenics, Sir Francis Galton himself. "Eugenics is the science which deals with all influences that improve the inborn qualities of a race; also with those that develop them to the utmost extent."[2]

The question of the relative weights of nature and nurture, of heredity and race, of environment and training, are very wide indeed, and our present knowledge of them is only partial. Though heredity is most certainly extremely important, let us not neglect environment, education, early training, and discipline. By heredity we have an innate capacity for growth and a tendency to grow more readily along certain lines than others. It is environment which gives or withholds that very opportunity which is most necessary for the proper development of innate capacity of any sort. Environment can surely make the very most of heredity. But can it not also dwarf or frustrate it? Moreover, it can very frequently, perhaps even in most cases, overcome inherited tendency to develop in a particular direction.

We are just beginning to appreciate the possibilities, the wonderful and far-reaching results of proper education, training, discipline, and stimulating environment, especially in the mental and moral fields. It is generally realized

that our present methods of education are faulty. Education is the giving of opportunity. Our current educational methods do not give full opportunities to heredity. For this reason education is to-day the great topic of discussion. It is the central problem of all advanced civilizations. A great educational revival along many lines is needed. The questions of public hygiene and sanitation, of personal, physical, and sexual hygiene, of mental hygiene, and of domestic science are being widely discussed. We note how readily the movements against such diseases as malaria, tuberculosis, cancer, hookworm, and pellagra are supported by the populace. It is the medical profession that is looked to for advice. We need a campaign of education in respect to insanity, epilepsy, and feeble-mindedness and in respect to alcohol and other social diseases—then will come the prevention, cure, and treatment. The effects on the physical and mental life of the nation would be most far-reaching. The health of the nation is intimately bound up with its morality.

School training should be toward self-supporting things, such as the manual arts; about personal hygiene, which is the religion of the body; about civics, which is the religion of citizenship; and about sex, which is of the utmost importance with the present-day dangers of urban life. The advances in psychology, child-culture, and pedagogics are encouraging. What may we not expect from hygienic surroundings and proper educational methods?

There is social unrest stirring throughout the country to-day. Social and economic conditions have changed. But shall tradition and custom remain unchanged, or adapt themselves to their new environment, their new conditions? Biology teaches us to adapt ourselves to our environment, while at the same time endeavoring to change and shape it to suit our needs. So with eugenics and its objects. There are new economic, political, and social problems. New methods of dealing with these questions are necessary. We must adapt ourselves to these new conditions and try to shape or correct them to more perfectly fit our needs, longings, and desires. The evils which have accompanied the changed conditions are not self-corrective, but cumulative. What shall be our attitude? Shall we, in typical *laissez faire* manner, helplessly view the spectacle and shake our heads sorrowfully? Or shall we rather lift up our heads, stare the problems full in the face, and meet them as man to man? They are there before our very eyes. We cannot and must not be blind to them, except at our own peril. Let us, like men, meet these new social conditions. Let us be up and doing, as it was intended that we should be.

"Now the problems on which turn not only our own enjoyment of life, but the enjoyment of life by others (upon which our own largely depends), are essentially family and social relations. It is on these family and social problems that the improving and impairing of the racial qualities of future generations mainly, if not entirely, depend. A right judgment on them is essential to good citizenship." Karl Pearson[19] could not have said a nobler thing when he made this statement.

A proper understanding of public hygiene and sanitation, of personal, physical hygiene, sexual hygiene, and mental hygiene, together with instruction in domestic science for girls and in the manual arts for boys, will prevent the evil effects of the racial poisons, of poor environment, of improper methods of living. It will lower the infant mortality and, with proper child-culture and pedagogy, will give a new moral aspect to life.

There are numerous questions which at once present themselves for our

consideration at this point, but in this paper we must limit ourselves to a brief discussion of three very important problems—the need for instruction in sexual hygiene, domestic science, and mental hygiene.

1. *The Sexual Question.*—If we ponder for a moment, we will see that this is the fundamental theme of the whole science of eugenics. And it is along this line alone that any definite steps may be taken.

The questions of control and prevention of prostitution, the wisdom of teaching methods for the intelligent control and limitation of the number of offspring by prevention of conception, the prevention of venereal diseases and their widespread havoc, medical examination before granting of marriage licenses, asexualization of the positively unfit classes by compulsory sterilization or segregation, the effects of the racial poisons, higher education for women, the industrial emancipation of women, a single or double standard of sex ethics and morals for men and women, the growing recognition of equal rights in general, uniformity or revision of marriage and divorce laws—all these, essentially and fundamentally, have to do with various aspects of the sexual question.

To touch upon but a single, though important, aspect, let us consider the social diseases.

When we consider the enormous prevalence of these diseases, the danger to the public health, the peril to the family (parents and offspring), the economic significance and the menace to the vitality, health, and physical and mental progress of the race, we must feel that it is high time to put aside our hitherto indifferent attitude of helplessness, to raise a warning finger, and to endeavor to stem the onrushing tide. When we are told that the social diseases give origin to fully one-eighth of all human disease and suffering, that it is estimated that at least sixty per cent. of the young men in the United States who yearly reach the age of early maturity will at some time in the course of their lives be victims of some kind of venereal disease, that more than eighty per cent. of these victims are infected before they pass through their thirtieth year, thus being attacked during the most active and reproductive period of life; when we are informed that syphilis is the cause of ninety per cent. of all cases of locomotor ataxia, of seventy-five per cent. of all ocular paralyses, of from ninety to one hundred per cent. of all cases of general paresis, and of forty-two per cent. of all abortions, as well as being a most potent factor in the causation of deafmutism, idiocy, and many incurable and incapacitating diseases of the circulatory, genito-urinary, and other systems, and that from sixty to eighty per cent. of children born with syphilis are dead at birth or die shortly afterward, while the rest are subject to degenerative changes which may be passed on to the third generation, for, of all diseases, syphilis alone can be transmitted to offspring in its full virulence; when we learn that gonorrhœa is the direct cause of eighty per cent. of the deaths from inflammatory diseases of women, of over sixty per cent. of all gynæcological operations, and that fifty per cent. of infected women become sterile as a result, while eighty per cent. of all cases of ophthalmia neonatorum and twenty to twenty-five per cent. of all blindness result from infection by the gonococcus [23]; when we consider these things and see about us the awful consequences and the havoc of prudery and note the far-reaching effects upon the present and future generation, surely we cannot justify our policy or conspiracy of silence on this subject. Although a correct estimate of the prevalence of these diseases cannot be made, Morrow [24] is not far from wrong

when he declares that "the prophylaxis of these diseases is the most pressing problem of preventive medicine that confronts us to-day." It is a question which has not only a sanitary and economic importance, but is most positively of tremendous humanitarian significance. William J. Robinson recently stated that ignorance is the cause of all the world's misery, and sexual ignorance is the cause of a great part of it.

What shall be done? No one willingly desires to contract any of these diseases nor to transmit them to others. And yet, through ignorance, our innocent women, our immature and irresponsible young, our innocent wives and unborn children must fall victims to the ravages of this true plague. It is time indeed that an educational campaign was launched. The American Society of Sanitary and Moral Prophylaxis is doing good work along this line by lectures and pamphlets. It now has a quarterly publication entitled *Social Diseases.* The various societies which have been formed since the inauguration of this work in 1905 have become affiliated under the title of "The American Federation for Sex Hygiene" for the purpose of more extended and effective work.

What is the best means for the dissemination of this knowledge? The subject must be handled carefully, chastely, in a refined and truly scientific spirit. We cannot expect the inertia of tradition and prejudice to yield in a moment. In the past this subject has been quite generally tabooed. It was a matter which was whispered about or not talked about at all. A policy of mystery and silence has dominated the entire subject. The discussion of sex was considered low, bad, disagreeable, and improper. What knowledge of sexual matters was gained by laymen, especially during those perilously dangerous years of puberty and adolescence, was gleaned by stealth from unreliable and unclean sources, and only too frequently in a not too virtuous company. We must do away with the unnecessary worry and self-reproach of the uninstructed adolescent, the deceit and hypocrisy maintained by children and parents and others toward each other on this question, and, by teaching the truth in a perfectly proper and natural way, to correct the false ideas and ideals which are the inevitable results of our present methods of education.

I do not see that we need fear lest increase in such knowledge should increase vice. It is certain that mere knowledge of evil does not in itself result in impaired purity and innocence. It is the manner and the surroundings in which, and the object with which, this knowledge is imparted. "A knowledge of the fundamental principles of the science of life cannot fail to enrich, enlighten, and ennoble the life of every human being."[10] This applies to sexual physiology and hygiene in no less degree than to biology. Is there any one of us who, in looking back on those years during which he was entirely ignorant of sexual matters, does not now feel that it was very wrong to have thus kept him in total ignorance of facts concerning which, of all things, he should have been given full and correct information? What a flood of light it sheds on our faulty methods of education!

Granted that instruction in matters of sex is necessary, by whom shall it be given and at what age shall it be begun? Shall this knowledge be imparted by the school, the church, the physician, or the family? The average teacher and minister shrink from this as a delicate subject; nor are they competent, since they themselves lack the necessary knowledge. The physician sees the insufficiency of only occasional talks on personal and sexual hygiene, and believes

that this subject is a moral rather than a medical one. No doubt, instruction in the home would be the most desirable. But, as most parents are not themselves in any way fitted for the task, the burden comes upon the teachers in the school. The child will be father of the man. The children of to-day make the parents of to-morrow. But they cannot receive the necessary instruction unless the parents and teachers are themselves competent. To remove this unpreparedness, now so universally existent, we must have a general discussion among teachers and parents, with lectures to them by physicians, and plans for the addition to our school programs of biology and sexual physiology and hygiene.

The task of educating the parents and teachers in sexual matters by lectures, pamphlets, and books recommended is being carried on, in so far as it can, by the Society of Sanitary and Moral Prophylaxis.

But when shall this instruction be begun in the young?[28] The children of to-day should not in the meantime be permitted, in like manner as their parents, to grow up into puberty and adolescence with little or practically no knowledge of sexual matters. Nor should this education be delayed till the child has reached the age of sixteen. Many children leave school at this age, or frequently sooner, perhaps never again to receive instruction of any sort by tongue or pen. For three years instruction in sex hygiene with the teaching of anatomy in the schools preparatory for the university has been given in Austria. It was recently introduced experimentally in the course for those pupils who leave school in their fourteenth year. It has been a part of the curriculum in German schools for two or three years.[29] It is now recognized that this instruction must be begun much earlier than most of us are wont to think.

In the matter of education in sexual physiology and hygiene we must consider the home and kindergarten stage, the prepubertal stage, and the adolescent stage.

The responsibility for instruction in the first period comes entirely on the parents—the father in the case of boys, the mother in the case of girls. This stage will be referred to shortly when we discuss domestic science.

For the second and third stages many plans for courses of instruction have lately been mapped out by educators and others especially interested in this question. The most desirable method of sexual education in the schools may be summed up as follows: the teaching of the elementary principles of biology under well-trained teachers in the primary school or the prepubertal period, this to be supplemented, especially toward the end of the course, by teaching in a more personal and direct manner by parents or physicians; the general laws of life being thus explained in plants, fish, etc., this nature study, proceeding gradually and naturally to the study of man, will make easy the treatment of sex physiology and hygiene in the high schools, to be subsequently followed by instruction in the perils of the social evil or the dangers of the abuse of the reproductive organs in the colleges. Many experiments are being made along this line, special courses have been given in some high schools and colleges, and the reports are decidedly favorable.

As the individual most capable and competent to give instruction in these matters, the physician here stands supreme. The medical profession must teach, provide leaders, and awaken enthusiasm in the public. There are those who tell us that the physician should teach medicine, but that he has nothing to do with the morals of society. Why not? The questions of biology, sociology,

sexuality, morality, and eugenics are most intimately interwoven with medicine. As White[27] has so aptly put it, "He (the physician) is a quiet, unostentatious, though constantly working, educator of the people, and I believe that largely through his efforts the laity will in time come to a correct understanding of the evil effects of faulty unions and bad methods of education, and that such knowledge will be employed by them in the application of rational methods of prophylaxis, which after all offers the only satisfactory solution of these problems yet reached."

The physician must become the teacher. He must lead the way to physical, mental, and moral health. He must teach the people that infectious and contagious diseases of all sorts are preventable, in all cases (as in malaria, typhoid fever, venereal diseases, etc.) or in most cases (as in infant mortality and tuberculosis); that diseases due to uncleanly, unhygienic, or insanitary practices (such as those due to defective milk-supplies or food-supplies) are positively wholly preventable; and that there are but few true racial poisons (lead, syphilis, alcohol, etc.), the evil effects of which are not absolutely preventable. It should be generally recognized that hygiene of mind and body is of first importance to a community. To build up a stable and sound nation all its citizens must be sound in mind and body. And yet we have no National Department of Health with a public health officer in the presidential cabinet! It the health of the community of so little importance to a nation that it is given such little recognition?

There are already some tendencies in the right direction. We are having an increasing degree of public medical inspection in the public schools. Efficient municipal health boards are being established. Every state must have its State Board of Health and the country must have its National Department of Public Health.

As reported in an editorial in the *Journal of the American Medical Association*, November 25, 1911, Prof. C. R. Bardeen, in a recent address to the graduating class of Chicago University, emphasized "the increasingly important relation of sociologics to medical questions; the necessity of training physicians on broad sociologic lines in addition to their medical training in order to meet the requirements, and the necessity for physicians to take the lead in all sociologic movements; and, last, the duty of medical colleges in their teaching to recognize the demand for properly-trained physicians to become leaders in all matters relating to the public health, as well as to make them competent physicians for treating individual diseases or patients."

We should, as you see, remember that the physician's duty is to the individual, the family, the community, society, the nation as a whole.

2. *Domestic Science and Pedagogy.*—We next approach the subject of domestic science for girls. The tremendous importance of this science is only beginning to receive its full share of appreciation. Some schools and colleges are now giving valuable courses in this subject. The questions of infant mortality, the sanitation and the general care of the home, antisepsis and asepsis, instruction in the care of children and in the principles of hygiene and nursing of the sick find their place here.

The results of bad or neglected home training are generally recognized. Domestic science finds great help in the recent advances in psychology, child study, and pedagogy. Teacher and parent are responsible for proper training

in these fields. But the mother is the chief instrument. The wholesome impressions from childhood consciously and vividly last through life, and the impressions gained in the years up to adolescence are the ones which contribute most toward building up the foundations of the character of the future adult.

As Freud has demonstrated in his "Three Contributions to the Sexual Theory"[28] the existence in early childhood, even from birth, of the germs of sex instinct, and has very ably supported the thesis that the whole progress of civilization is founded on a sublimation of the infantile instincts, particularly of the sex instinct, its importance for education and personal hygiene should not be overlooked. The child's education, in sex as in other matters, should be begun as soon as the first questions are asked. Myths and side-stepping replies should be religiously avoided. Give the child a right start in life. And truth should be its foundation.

Education and discipline should not be merely a stuffing of the memory. It should be a developing, an unfolding of the mind. Knowledge itself does not mean much unless it is properly supported by right feelings, right attitudes and points of view, right habits and ideals. The importance of the formation of proper habits of cleanliness and care of the body, the implanting of the feelings of its sacredness, the instilling of high-minded thoughts, of right ideas in life cannot be overestimated.

Infant mortality, for example, destroys alike the fit and unfit. The chief cause of excessive infant mortality is not disease, but ignorance, neglect, and mismanagement. The child should have free-play up to the age of seven. Its physical health should be especially looked after during this period before school. Its nervous system undergoes the greatest development during this time, and it is the period of laying the basis of good general health. We also know that home conditions during these first seven years of life may bring out the best or worst that is in a child. Child labor and employment of women have their most damaging effects during this early stage of the child's life. Not many months ago Jacobi, of New York, after giving statistics showing that the industrial conditions in many of our communities are largely responsible for our unnecessarily high infant mortality, was reported to have stated: "Women working at home are very often worse off than even their sisters in the factory. The constant treadling of the machine undermines their health. Seamstresses develop anæmia, tuberculosis, and pelvic diseases. Cigarmakers who work at home develop consumption to the extent of ninety per cent. Such women living in dirty dwellings, without air or sunlight, bear children that are starved before they are born—who are infected with hereditary disease—who are destined either to perish miserably, or, more miserably, to populate asylums, hospitals, and penitentiaries."[29]

Child-murder, child-torture, and child-neglect in the earliest years of life, first at home and later both at home and in the school-room, are responsible for much of the evil, disease, crime, and degeneracy which surround us on every hand. The work of the juvenile courts, of such men as Dr. William D. Healy of the Juvenile Psychopathic Institute of Chicago, and observation of the classes for backward and atypical children in the public schools, together with a study of the past life-histories of many of our delinquents, defectives, and dependents, show us that it is in the school-room and in the home in the early impression-

able years that many of those who go later to fill our prisons, reformatories, penitentiaries, jails, and workhouses are first formed. It calls for a change in our system of education. Our schools guide the intellectual development of our children; their physical constitution is also considered, for we now look after the eyesight, the teeth, adenoids and tonsils, contagious diseases, physical and even mental defects. Should not moral education find its place here? It is only thus that preventive measures can be carried out. Our children must be taught the value of proper environment and good habits, the far-reaching, disastrous effects of alcohol and the sexual diseases, the necessity of general physical and sexual hygiene, and, last but not least, the power of self-control and the principles of mental hygiene.

3. *Mental Hygiene.*—The present neglect of mental hygiene in our medical colleges finds no basis in fact. The struggle for existence to-day is that of mind against mind. Surely something should be taught, at least in medical colleges, of the hygiene of the mind.

Mental hygiene and prophylaxis must find a place high in the scale of practical medicine and hygiene. Many mental diseases are dependent on physical disorders and obviously preventable; such are mental disorders due to toxic and infectious diseases like typhoid fever, yellow fever, malaria, smallpox, diphtheria, etc. (all of which are plainly avoidable), to tuberculosis (which is in great measure preventable), and to syphilis and alcoholism (which are absolutely avoidable).

The necessity for a due proportion of time for recreation and work, for variety versus monotony, for regular and sufficient hours for sleep and rest, for fresh air, good food, hygiene, and sanitation must be fully valued in their relation to sound mentality. A sound body is the first essential for the best functioning of the mind. The effects of the racial poisons, especially alcohol and the venereal diseases, should not be underestimated.

However, it is not only the physical causes of mental disorder, but the psychological factors as well, which find their place in education.[30] We cannot too strongly urge the need for self-mastery and self-knowledge, of understanding one's self thoroughly. The sexual passions, disappointments in love, business failures, ambitions not realized, dreams that don't come true—all sweeping emotions must be controlled by calm reason and judgment. Our passions must be cooled. Anger, resentment, dissatisfaction, should not overpower us. Constant grumbling, complaining, and fault-finding lead nowhere. The substitution of self-mastery for emotional outbreaks is easy when begun early, but very difficult or impossible if begun late in life.[31] We must fill the child's mind with these ideas. We must likewise do what we can in this respect with the grown-ups. Medicine, psychology, and pedagogy are and must be associated.

Let us, as Arnold Bennett tells us in "The Human Machine," say to ourselves:

"I ought to reflect again and again, and yet again, that the beings among whom I have to steer, the living environment out of which I have to manufacture my happiness are just as inevitable in the scheme of human evolution as I am myself; have just as much right to be themselves as I have to be myself; are precisely my equals in the face of Nature; are capable of being explained as I am capable of being explained; are entitled to the same latitude as I am entitled to,

and are no more responsible for their composition and their environment than I for mine. I ought to reflect again and again, and yet again, that they all deserve from me as much sympathy as I give to myself. Why not? Having thus reflected in a general manner, I ought to take one by one the individuals with whom I am brought into frequent contact, and seek, by a deliberate effort of the imagination and the reason, to understand them, to understand why they act thus and thus, what their difficulties are, what their explanation is, and how friction can be avoided. So I ought to reflect, morning after morning, until my brain is saturated with the cases of these individuals. Here is a course of discipline. If I follow it I shall gradually lose the preposterous habit of blaming, and I shall have laid the foundations of that quiet, unshakable self-possession which is the indispensable preliminary of conduct according to reason, of thorough efficiency in the machine of happiness." [32]

We must bring our ideals down to a human, practical level. That is the only way to gradually approach the ideal. Let us by all means have our ideals. Never give them up. They give us life, hope, ambition, something to strive for, to look forward to. But let us not live only in ideals. There is the practical world of men and women who surround us on every hand. Let us apply the ideals as best we can. If we cannot accomplish the ideal, let us get as near to it as we can. We must appreciate that of all things we must adapt ourselves to existing conditions. We must meet face to face that particular life that we have to lead. We must do this for self-preservation. Therefore let us measure up to our life's demands, adapt ourselves to them as best we can, and make the most of them, though at the same time trying to mould and shape conditions to more nearly fit our own inner longings and ambitions.

Contentment in life, you know, is nothing more than a way of thinking. And the more a man thinks in right directions, so much the more happy is he likely to become, and so much less a slave to environment will he find himself.

What wonderful results may flow from a divergence of energy from the sexual instincts and passions, from disappointments, from a general dissatisfaction and discontent with the course of events and the lot accorded us by fate, to an expenditure of some of this energy in other and higher goals—science, art, literature, music, variety, interest in life's activities in some way or other, I care not what, so long as it be good! Conservation is the demand of the day. Conservation of waste! Of waste in agriculture; of waste in human lives by infant mortality and the numbers of defective, dependent, and delinquent classes, sacrificed on the altar of gross neglect; conservation of time, of energy, of mind, and of pleasure. This is the crying need of the times.

"Why," we will say to ourselves, "this means nothing more than an active life." Yes, that is just what it means, with one exception or addition—an active life based on the right ideas.

Does this not give one an optimistic view of life? Does it not make one look forward to happiness? And is it not happiness that each one of us is striving for? Yes. But let it be that happiness which is highest, which has its birthplace in the noblest thoughts and objects of mankind.

We are told that we have no free-will; that we are led on by determinism; that we are irresponsible individuals who have certain ways of thinking, feeling, and acting. We are just built that way, don't you know. Therefore we can't change our way of living or of looking at life, so what's the use of striving

hopelessly to do so? To this I reply that though it is true that our powers of free-will may be merely illusory, nevertheless every one of us feels that they exist within him. As Arnold Bennett puts it, "The historic question, 'Have we free-will, or are we the puppets of determinism?' is fascinating and futile. It has never been, and it never will be, settled. The theory of determinism cannot be demolished by argument. But in his heart every man, including the most obstinate supporter of the theory, demolishes it every hour of every day. On the other hand, the theory of free-will can be demolished by ratiocination. So much the worse for ratiocination! *If we regard ourselves as free agents, and the personalities surrounding us as the puppets of determinism,* we shall have arrived at the working compromise from which the finest results of living can be obtained. The philosophic experience of centuries, if it has proved anything, has proved this. And the man who acts upon it in the common, banal contacts and collisions of the difficult experiment which we call daily life will speedily become convinced of its practical worth." [32]

Whether we are forced to do this or that because of determinism or free-will is immaterial. Since our hereditary potentialities may be so wonderfully modified by environment in every way, suppressing the bad and bringing out the good, let us take advantage of good habit formation, for habit, you know, is like a cable: you weave the thread till you cannot break it.

And what is the object of all this prevention of faulty unions and bad methods of education? Why? Whither? Eugenics, says Galton, has for its final goal "the evolution of mind, body, and character in increasing energy and co-adaptation." With Tennyson, we are unconsciously striving to reach the

"One God, one law, one element,
And one far-off divine event
To which the whole creation moves."

In conclusion, I may say that eugenics teaches us not to wait for a future heaven as a relief from this life of ours, not to gladly crawl away from the fray and let it rage on in all its mad fury, but to enter into the struggle and give a helping hand towards the betterment of conditions. The quality of society depends upon the quality of each individual. This earth of ours can be made worse or better according to the conduct of its component individuals, just as a home is made quiet, orderly, and happy or disturbed, disorderly and wretched by the general conduct, actions, and words of those who have the making or unmaking of home life in their own hands. Each one of us must do his own little share. Understand thyself. Know thyself. Shine where you are, for it is no disparagement to the little star that there is a larger sun.

"I sent my soul through the Invisible,
Some letter of that After-life to spell:
And by and by my soul return'd to me,
And answer'd 'I Myself am Heav'n and Hell.'"

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State Medicine

THE NATIONAL INSURANCE ACT (1911) FOR THE UNITED KINGDOM

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On May 4, 1911, the Chancellor of the Exchequer (Mr. Lloyd George) of the United Kingdom of Great Britain and Ireland introduced the National Insurance Bill into the House of Commons; in the closing days of December it became the law of the land under the name of the National Insurance Act, and was described as "an Act to provide for Insurance against Loss of Health and for the Prevention and Cure of Sickness and for Insurance against Unemployment, and for purposes incidental thereto." The bill was, therefore, before Parliament and the country for nearly eight months, and these months were in a year which is likely to become historical on account of the gravity of the constitutional crisis then in existence between the two Chambers, Lords and Commons, by which the British Empire is governed. Into the midst of a session agitated by the clash and turmoil of a House of Lords Reform Bill, of a Referendum Bill, of a Revenue Bill, and, most of all, of a Parliament Bill to abolish the veto of the Upper House—into the midst of such a session there was projected a National Insurance Bill which at the time of its introduction contained eighty-seven clauses and nine schedules, and covered eighty-two foolscap pages, which during its progress was harassed and embarrassed by amendments almost numberless (it is said that on one fateful night in November no fewer than four hundred and seventy amendments were voted upon under the closure), and which at the end emerged as an act containing one hundred and fifteen clauses and nine schedules and introducing enactments and regulations so complicated, so various, and so novel as to necessitate the publication of explanatory pamphlets to make them clear to the public.

"THE MAGNA CHARTA OF THE POOR"

The National Insurance Act is the second great legislative measure in what has been called the Magna Charta of the Poor. The first was the Old Age Pensions Act: at a cost to the State of £13,000,000 every necessitous old man and woman in the British Isles is certain of receiving a pension of five shillings weekly on reaching the age of seventy. This beneficent scheme has now been in action for two years, and he would be an amazingly foolhardy politician who would talk of repealing it. Having attacked and solved the problem of provision for the aged poor, the Liberal Government next proceeded to attempt to deal with the greater difficulty of the sick workers of all ages, and the National Insurance Act is the outcome of this attempt. It is calculated that this act, when it has come into full operation (say in eighteen years, for it is on a contributory basis and so needs time for development), will cost the State £8,000,000 annually. Of course, many millions more will be dealt with, but they will come from the workmen and their employers who enter the insurance scheme. The two acts (Old Age Pensions and National Insurance), these two great measures of social reform will, therefore, be the means of distributing some £21,000,000 a year among the workers and the poor of the United Kingdom; and it is claimed for them at the same time that they will "develop self-respect in the classes dealt with and accustom them to the exercise of civic duties."

BENEFITS OF THE ACT

To give the reader an idea of the mode of working of the act and of the benefits which it secures I cannot do better than quote the words of Mr. Lloyd George, the author of the bill, as used at an interview which he granted to a journalist (the late Mr. W. T. Stead) just about the time when the passing of the bill was fully assured. The Chancellor of the Exchequer is reported to have spoken as follows: "The National Insurance Bill, unlike the Old Age Pensions Act, is on a contributory basis. That is to say, whereas the old age pension is paid to any person who arrives at the age of seventy, without having made any contribution to the pension fund other than that of having paid rates and taxes during his long life, the Insurance Bill is an attempt made by the State to compel work-

men and employers to co-operate in a great insurance scheme for the benefit of the workmen. The State simply puts a premium, so to speak, upon the contributions of the employers and employed. That is to say, the workman pays 4d., the workwoman pays 3d., and the State adds 2d. So far as the workman is concerned, he pays 4d. a week and is credited with 9d., which he takes out in benefits." Asked what the benefits were, Mr. Lloyd George replied: "The working man pays 4d. a week and the working woman pays 3d. a week. In return they are guaranteed free medical attendance when they are ill, 10s. a week for twenty-six weeks when they are off work owing to ill-health if they are men, or 7s. 6d. per week if they are women, and if their malady is incurable and they are permanently incapacitated from earning a living they receive 5s. a week until they are seventy years of age. Then they will ordinarily become old age pensioners and draw their 5s. a week like other pensioners. In addition to this there is a maternity benefit of 30s. for women at the time of their greatest need, and special provision is made for the cure of sufferers from consumption. What the bill aims at doing is to secure medical attendance for every man (and woman) in the land, to secure that he has 10s. a week when he is laid up by temporary sickness for half a year, and 5s. a week if he is permanently incapacitated."

Now the objects of this act are most commendable and praiseworthy: to secure medical attendance for the working man or woman during illness, to prevent wages ceasing entirely during temporary incapacity for work, to put a welcome sum of money into the family purse when a new life is being brought into the world, and to carry on a systematic campaign against tuberculosis, that great White Plague, these surely are aims to which no one can take exception. And these are not all, for there are clauses whose effect will be to detect insanitary dwellings and to penalize the owners of slum properties, and there are others which will operate against the employer who sweats his work people. Why, then, it may be asked, has this bill met with such determined resistance? Why was it that its passage through the House of Commons had to be forced by means of all the most powerful legislative devices for the purpose of making the bill an act? Why had the Chancellor of the Exchequer to use "almost superhuman energy and tact" to overcome the obstacles

which stood in its way? Why, above all, was the medical profession of the British Isles almost to a man opposed to it? Why, again, did the members of the House of Commons who welcomed its introduction with such remarkable unanimity so bitterly oppose its progress and so nearly prevent its passing?

OPPOSITION TO THE BILL

To answer all these questions would take up too much space and would lead me too far away from the medical aspects of the matter; but one or two remarks may serve to throw some light upon the subject. In the first place, a bill which is introduced into Parliament by one of two great political parties must, almost of necessity, expect to meet with opposition from the other party. At first, when only the general principle is under consideration, the opposition may be veiled; but later, when generalities are being replaced by particulars, dislike will harden into obstruction and amendments designed to modify will become resolutions intended to wreck the measure. Further, a piece of legislation which depends for its success upon the compelling of one class of society to pay for benefits in which it will not directly share is foredoomed to be resisted by the people who have to pay but who are not to profit thereby. The substitution of a system of compulsory, regular, and continuous giving for one of free, irregular, and intermittent charity will be opposed not only by those who have never given and who do not wish ever to give but also by those liberal-minded people who have given spontaneously of their abundance and who object to have their charitable offerings converted by law into weekly or monthly taxes. Every one is familiar with the man who is willing to concede *de bonne volonté* what he resisted being concussed into giving, who is ready to have his pocket plundered so long as his pride is spared. Many employers of labor were therefore opposed to the bill, although some of them were far-seeing enough to realize that they would be losing nothing and might be gaining something if the result of the insurance scheme turned out to be increased physical fitness of the men and women employed. The Employers' Liability Act and the Workmen's Compensation Act had also paved the way, in some measure, for the Insurance Bill. But, curiously enough, opposition came also from the side of the employed: to the healthy and strong there was little

that was attractive in paying so much per week into a fund from which they might never require to draw out; others were sceptical as to the realty of the benefits promised; and yet others, especially, perhaps, the domestic servants, resented what they regarded as a tax of three pence per week. There were doubtless other objections founded upon special circumstances. In time, however, the Chancellor of the Exchequer was able to meet many of the objections; some opponents he conciliated, some he showed to be in error, some he convinced, and the obstruction of others he wore down by pertinacity and patience and pluck. But the medical opposition was not so easily met; possibly Mr. Lloyd George did not quite understand, or at any rate appreciate, the full significance of all the causes underlying it; and, although the bill is now an act of Parliament, it threatens to be a dead letter unless the full, hearty, and free co-operation of the medical profession can be secured. What, then, were the difficulties which prevented the doctors of the British Isles welcoming, or at least accepting, first, the bill, and, second, the remodelled bill which became the act?

MEDICAL CRITICISM OF THE BILL

The first difficulty lay in the experience which the medical profession had of the evils and hardships of club and contract practice; for twenty years and more many of its members had been groaning under the domination of the friendly societies, and were now looking forward to release; just two months before Mr. Lloyd George introduced the National Insurance Bill into Parliament the British Medical Association had sent down to its divisions all over the country its report on the organization of medical attendance on the provident or insurance principle, and had invited replies to a series of questions bearing thereupon; medical men everywhere had had their minds directed in a very special way to the matter of their relations with the sick poor or with societies representing them; and with a remarkable degree of unanimity the answers received from all the districts had shown that practitioners were alive to the increasingly difficult position which they occupied in respect of club and contract practice, and were impatiently expecting reform in several directions and in many details. To quote from an editorial in the *British Medical Journal* (June 10, 1911), the profession realized that it

had "acquiesced in the system of attending artisans for remuneration which was a mere acknowledgment of an unfulfilled obligation, on the plea of humanity, and at a time when the wages of artisans were admittedly nearly as inadequate to their needs as the remuneration paid to their doctors was incommensurate with the services actually rendered." They realized, further, that "the concession had been converted into a system, and unconscionably extended and abused; there had been here and there some bright exceptions, but, as a rule, and speaking of the country as a whole, the friendly societies and clubs had shown themselves harsh, inconsiderate, and incompetent in their dealings with the medical profession and the administration of medical benefits." It can, therefore, be easily imagined what alarm, dismay—nay, consternation—the members of the profession saw, when the details of the National Insurance Bill were made public, that they had been not in any way delivered from what many of them had felt to be the tyranny of the friendly societies, but had been more firmly shackled than before. A system which had been declared to be in great need of radical modification, if not of complete abolition, was now in process of being not only stereotyped but enormously extended. What doctors had done in the past in exceptional circumstances, out of sympathy for the suffering poor, as a means, perhaps, of making a beginning in practice, and for a remuneration which was not regarded as full payment but merely as a recognition of indebtedness, was now to be done under command; and it was to be so widely extended as to threaten the very existence of more adequately remunerated private practice. Is it to be wondered at that the medical profession looked askance at the National Insurance Bill?

NEGLECT OF PRELIMINARY CONSULTATION

In the second place, the medical profession, and more particularly such representative bodies as the British Medical Association and the Royal Colleges of Physicians and Surgeons, resented the introduction of such a measure as the National Insurance Bill into Parliament without previous consultation between the Chancellor of the Exchequer and the practitioners upon whom would fall the responsibility and the *onus* of carrying out the provisions of the act when it became law. At a meeting of the medical profession in

Edinburgh in June, 1911, Dr. Cox, Deputy Medical Secretary of the British Medical Association voiced this grievance: "For nearly a year Mr. Lloyd George had been consulting the friendly societies, trades unions, and various other organizations, but had not taken the trouble to apply to the British Medical Association. Last November the association had forwarded a memorandum putting its experience at his disposal, and had by persistence obtained an interview with him; but he had not permitted the association to see the bill confidentially, though he had done this in the case of the friendly societies." It may be said that this was a small matter and not one which should have had any influence upon the reception of the bill; that it was mere sentiment. But human nature in the medical profession is the same as outside of it, and it is just such things as this which alter the fate of the greatest affairs and wreck the most promising schemes. There can hardly be a doubt that some such preliminary consultation with the heads of the medical profession would have so modified many parts of the bill as to have greatly facilitated its passage through Parliament and possibly secured its acceptance by the men upon whom the Chancellor was relying to make the act effective. As it was, the neglect to do so was the cause at least of some of the intense dissatisfaction with which the bill was received, and added materially to the number of amendments which were moved during its consideration.

THE SIX CARDINAL PRINCIPLES

The mention of amendments brings me to the third difficulty which the profession had in accepting the bill. Medical men were willing, somewhat reluctantly, of course, to give up the idea of a Utopia in which there should be no contract practice and no friendly (save the mark!) societies; they were ready to forget that their opinion had not been asked about matters so vitally important to themselves as were contained in the bill; but they felt compelled to criticize the details in the draft which seemed to them dangerous for, or even destructive to, medical practice. That the bill contained many things which indeed called for amendment was not long in doubt; but only those matters of medical interest need be considered here. Professional criticism soon took shape in the form of what came to be known as the six cardinal principles. These were the

six matters which the profession agreed to regard as essential to the satisfactory working of the act from the medical standpoint; if these were assured, it was determined that medical men would try to carry out the Government scheme; if they were not granted, the practitioners of the country would refuse their services. The enunciation of the six cardinal points, therefore, constituted a threat of a general strike and revealed the existence of a hitherto unrealized sentiment of strong trades-unionism in the profession. Not a few were distressed with these developments, but feeling ran high and largely-attended meetings everywhere insisted on the six cardinal principles. The wording of these differed somewhat as carried at various gatherings of the profession in different places, but the same ideas were everywhere embodied in them; the order in which they were stated also varied, but this constituted no divergence of opinion. It would be more correct, perhaps, to call them the six cardinal principles of the British Medical Association, as indeed they were, but they were so generally accepted by the profession as a whole that the British Medical Association may be regarded as having voiced its opinions and crystallized its thoughts into words.

(1) *The £2 Limit.*—The first principle was called the £2 limit. In the bill, as introduced, there were two classes of insured persons, the compulsory and the voluntary; the former included all persons employed in manual labor and all other employed persons whose incomes were below the income tax level, *viz.,* £160 a year, with certain exceptions to be noted immediately; the latter, the voluntary class, was most elastic in its bounds, for, theoretically, it included every other employed person, every person, in fact, who received a weekly wage or an annual salary, whatever its amount. The exceptions to the compulsorily insured were chiefly those persons in the army, navy, and other services for whom special provision was already made, and the very casually employed laborers whose contributions could hardly be collected by any workable plan. The scope of the bill was, therefore, extraordinarily wide; it was so all-embracing that the Chancellor of the Exchequer himself could have entered it in the voluntary class. It was estimated that if the bill became an act at once more than 13,000,000 persons would be compulsorily insured and 800,000 in the voluntary class; at a later date the families of the workers would be able to participate, so that

in some years to come between 25,000,000 and 30,000,000 persons might be swept in. The far-reaching effect of this wideness of scope would be soon evident in the dwindling of private practices dealing with persons above what is called the ordinary 'workman' class and with others in receipt of good wages (say from £104 to £160 per annum). The scope was far wider than that of the friendly societies, which accepted only selected lives and did not deal with the wives and children; and it was because of these restrictions in the societies that medical men had been able to work under them. Now uninsurable or not-selected lives at least were to be included, as were also, before long, the wives and children. The first cardinal principle maintained that an income limit of £2 per week or £104 per year should be introduced into the bill. Some medical men were of opinion that it should be lower, if their private practices were to be saved at all; but all were emphatic in calling for the £2 a week limit as the maximum for insured persons. If a person's income from all sources exceeded £2 per week or £104 a year he ought not to be regarded as one to receive medical benefit. A great struggle took place over this matter, but in the end the £2 limit was *not introduced into the bill.* There was, however, inserted a clause which authorized a local insurance committee to require persons whose income exceeds a limit to be fixed by the committee to make their own arrangement for receiving medical attendance and treatment, including medicine and appliances, the committee making a contribution from its funds to the cost. There has been a difference of opinion as to whether or not this clause really secures the fixing of the £2 limit as a maximum; but it would certainly seem to place the power of doing so in the hands of local insurance committees, and even to give an opportunity of placing it still lower if local conditions seemed to call for it. In the act, therefore, whilst the £2 limit has not been introduced in so many words, it has in effect been provided for in a somewhat roundabout way which may be traversed safely enough, although perhaps slowly, so long as the profession does not divide against itself.

(2) *Free Choice of Doctor and Patient.*—The second cardinal principle was free choice of doctor by the patient, subject to the consent of the doctor to act. This was readily admitted and a clause embodying it was inserted in the bill as it passed through Parlia-

ment. In the fifteenth section of the act, subsection 2, arrangements are made such as will secure the right on the part of any insured person of selecting, at such periods as may be prescribed, from the appropriate list the practitioner by whom he wishes to be attended and treated, and, subject to the consent of the practitioner so selected, of being attended and treated by him. Insured persons who fail to make any such selection or who have been refused by the practitioner whom they have selected shall then be distributed amongst, and so far as practicable under arrangements made by the several practitioners whose names are on the lists. These regulations do away with the risks and difficulties which would have attended a whole-time medical service, and tend to secure the interests and maintain the status of private medical practitioners willing to work under the act.

(3) *Abolition of Control by Friendly Societies.*—The third cardinal principle could be stated positively as the transference of the administration of medical benefit to local insurance committees, or, negatively, as the doing away with the control of the friendly societies over the medical practitioners. This principle has also been secured in the act as it now stands. Section 14, subsection 1, states that sickness benefit, disablement benefit, and maternity benefit shall be administered, in the case of insured persons who are members of an approved society, by and through the society, or a branch thereof, and in other cases by and through the insurance committees; *medical and sanatorium benefits shall in all cases be administered by and through the insurance committees,* additional benefits shall be administered by the society or branch of which the persons entitled thereto are members, except where such benefits are in the nature of medical benefits, in which case they shall be administered by and through the insurance committees. This is quite clear and satisfactory; but a little obscurity is introduced into the matter by what has been called the "Harmsworth amendment," which constitutes subsection 4 of section 15 of the act, and which seems to allow any system or institution existing at the time of the passing of the act to continue to provide medical attendance and treatment. Another objection has been taken that the local insurance committees, containing, as they will, members to the number of three-fifths representing insured persons, will simply be the old friendly societies in

another form; but there is this very important difference that under the act the local insurance committees will not have the power (which the friendly societies possess) of appointing or dismissing their medical officers. Further, the wishes of the medical profession have been met in another direction in that each local insurance committee will be required to consult (see section 62 of the act) with a local medical committee "on all general questions affecting the administration of medical benefit, including the arrangements made with medical practitioners giving attendance and treatment to insured persons." Since the local medical committee will be elected by the profession in the district, "the medical profession (to quote from an editorial in the *British Medical Journal* for December 9, 1911) in each locality will, if it acts in unison as one body, but only so, be able to settle the terms upon which it will give attendance and treatment to insured persons, and will be able to prevent underselling or other conduct by members of the profession to which the general body objects." Now, considering the difficulties of the situation in respect to the powers which the friendly societies had acquired previous to the act, it must, I think, be admitted that the National Insurance Act has gone a long way to remove the shackles which the medical profession had allowed itself to be fettered with.

(4) *Medical Representation on Administrative Bodies.*—The fourth cardinal principle was closely associated with that just considered: it was adequate medical representation on the administrative bodies constituted under the act. These administrative bodies are the Insurance Commissioners (with a central office in London), the Advisory Committee, and Local Insurance (or Health) Committees. At first, in the bill, there was no provision for the appointment of a medical man to be an insurance commissioner or a member of the Advisory Committee. The bill, however, as amended, and the act as passed, requires that of the commissioners one at least shall be a duly qualified medical practitioner who has had personal experience of general practice. Further, in three new sections (80, 81, 82) applying the act to the special circumstances existing in Scotland, Ireland, and Wales it is enacted that Insurance Commissioners (to be termed Scottish, Irish, and Welsh, respectively) be appointed for each of these countries, and that one, at least, of them shall in each instance be a duly qualified medical practitioner. In

the joint committee, also, which this arrangement calls for it would seem that there is no bar to a medical practitioner having a place. With regard to the Advisory Committee, the act differs from the original bill in a very definite way, and gives practically what the profession asked for. Section 58 reads: "The Insurance Commissioner shall, as soon as may be after the passing of this act, appoint an Advisory Committee for the purpose of giving the Insurance Commissioners advice and assistance in connection with the making and altering of regulations upon this part of this act, consisting of representatives of associations of employers and approved societies, of duly qualified medical practitioners who have personal experience of general practice, and of such other persons as the Commissioners may appoint, of whom two, at least, shall be women." Finally, with regard to the Local Insurance (at first called Local Health) Committees, which may contain eighty and must contain at least forty members, there is the provision that in a committee of forty there must be at least four medical practitioners, in one of sixty at least five, and in one of eighty members at least six. This may seem but scant medical representation on so important a part of the administrative machinery of the act; but it has to be remembered that there are to be Local Medical Committees, to which reference has been made above, which will represent the medical profession in each district and will have the power of advising the Local Insurance Committee on medical matters (section 62). Whether these modifications of the original bill meet fully the requirements of the profession as expressed in the fourth cardinal principle will depend entirely upon the meaning given to the word "adequate;" but they at least mark a distinct advance, in the opinion of the framers of the act, in respect of the necessity of the medical practitioner having representation on the administrative bodies.

(5 and 6) *Method and Amount of Remuneration.*—The fifth and sixth cardinal principles expressed the mind of the profession on that most contentious matter, remuneration. The two principles were the settling of the method of remuneration of medical practitioners by the Local Insurance Committee in accordance with the preference of the majority of the medical profession in the district, and the settling of medical remuneration at a rate which the pro-

fession considered adequate. There was a difference of opinion in the profession itself as to the method of remuneration: some, perhaps a majority, thought that payment should be for attendance; others were willing to accept capitation payment, so long as the amount per head of the insured was adequate. Each method has advantages and each has disadvantages, and many pages might be covered with arguments pro and con; but it would be unprofitable here to attempt to discuss these complicated questions, all the more since the act leaves the matter unsettled. The question will require to be dealt with and finally adjusted by the authorities constituted under the act in consultation with the medical profession. The amount of remuneration is in a like unsatisfactory state. The profession is clearly of one mind that the sum of six shillings per head per annum (which has been named), with two shillings deducted therefrom to meet the cost of drugs, medicines, and appliances, is quite insufficient. It has been said, on the other side, that this is more than some medical men are now receiving from the friendly societies; but in connection with this statement two things, at least, have to be borne in view. One is that the lives dealt with by the societies are generally selected, and are less likely, therefore, to call for much attendance in the year. The other is that medical men working for such capitation grants have always expected to receive fees for visits paid upon members of the family of the man belonging to the friendly society, so that four or five shillings a year by no means represented what they drew in payment. In a word, the medical man has not in the past regarded the pay he has received from his club patients as fair fees for units of work done, but has looked upon such contract practice as a means to an end, as an introduction to the families of the persons paying into the friendly societies. What a fair capitation grant should be is a difficult question to answer; at some meetings of the profession ten shillings has been named and at others eight shillings and sixpence as adequate payment; but conditions differ so widely in different parts of the British Isles that it is doubtful whether any common rate could be agreed upon. One has only to think of a doctor practising in, say, a London suburb where all his patients might be within a mile or two of his own house, and of one at work in the highlands and islands of Scotland where several miles have to be covered in going from

one patient to another. But, whilst these difficulties exist, it must be pointed out that the act, by naming no sum at all, not even a minimum rate, leaves the whole question of remuneration in a dangerously vague state, and opens the door to the old abuses of ruinous competition, underselling, and unfair compulsion. No improvement of the national health can be looked for if the doctoring is to be done by harassed and underpaid medical men and women to whom holidays have become an impossibility and post-graduate instruction an unattainable luxury. A working class practice at the present time is a severe strain upon the strength of any man; it may, under the National Insurance Act, be impossible to find anyone willing to face it at all. Further, there may occur such a depreciation in the position of the medical man and such a lowering of his status that the supply of medical students at the various universities and colleges may fall to a level dangerous to the future welfare of the country.

I have tried to state the six cardinal points or principles upon which the profession were agreed if medical men were to work the act, and I have endeavored to estimate fairly the concessions or alterations which were introduced by the Chancellor of the Exchequer into the bill in order to meet them. It has been said that four of the principles have been embodied in the act, and that the two others can be met if certain conditions can be arranged; but it must not be forgotten that the medical profession did not ask for six things and make up its mind to be contented if it got three or four. It did not ask for the bill; it was not consulted about it beforehand; many of its members had not wished for the act in any form whatever. Others, however, were willing to do what could be done to make it a success, and they stated the irreducible minimum, so to say, needed before, in their opinion, it could be successfully worked. They were not prepared for bargaining or haggling; they were not, as has been said by angry politicians, "out for what they could get." With a practical knowledge of the medical difficulties of the position such as the Chancellor of the Exchequer did not possess, they were trying to aid him in making the scheme for which he and not they were responsible, a living, workable thing, and not a legislative stillbirth and dead-letter.

FURTHER CRITICISM

But the six cardinal principles do not contain all that has been brought forward in criticism of the medical details of the National Insurance Act. There are several other matters of medical moment in which the framers of the act seem to the profession to be treading on dangerous ground and preparing the way for disaster or, at least, for a serious dislocation of existing conditions. There is, for instance, the matter of the great voluntary *hospitals*, many of which depend for their support upon subscriptions from employers and employed. One can hardly help anticipating that much, if not all, the money which at present flows voluntarily from these sources into the hospitals will be, for a number of years at least, diverted to meet the compulsory payments made to the insurance scheme. As it is, many of the hospitals are very hard put to it to obtain contributions sufficient to enable them to carry on their beneficent work, and their condition when the sources of supply referred to above are cut off will become at once most precarious. Possibly the number of out-patients attending them may lessen, but assuredly there will be an increasing number of applications for indoor treatment. Then, again, the success of medical education throughout the country largely depends on the financial stability of the hospitals where the future medical men and women of the country receive their practical training. If the hospitals have, so to say, to shut down, medical education must suffer. There is hardly any likelihood of money being available under the act to be given to hospitals, but it is just possible that in time some funds may be forthcoming from the approved societies for this purpose, only these bodies must first be in a position to report a surplus.

Then, again, there is the difficulty of *second opinions* (*i.e.*, specialists' fees), of operations, of specialized methods of diagnosis (X-ray, etc.), and of expensive forms of treatment (vaccines, etc.). It may be said that these are the luxuries of medical practice, and that they are to be had in the hospitals. With regard to the former of these excuses, it must be borne in mind that the end aimed at is the early return of the insured person to work completely cured; a specialist's opinion or a timely operation or both may prevent weeks or months of ill-health; not to provide means for the obtaining of such things may, therefore, be very expensive economy in the long

run. With regard to the latter excuse, we have just seen that the act will, in all probability, throw a big strain upon the accommodation of our large hospitals, whilst it may cut off a large amount of their income.

POOR CONCEPTION OF A DOCTOR'S AIMS.

Perhaps one of the most serious objections to the way the medical part of the act has been conceived arises in connection with the notion of a doctor's duties and practice hinted at, if not directly expressed, therein. It would seem as if the framers of the act thought of the medical man solely as a person who pays a visit and orders a bottle of medicine; and that there is no such thing, for instance, as prevention and no treatment other than that by drugs. The modern medical man believes that he plays a more important part than that in securing the health of the community; and it will be a bad day for the profession and the public when he lowers his standard to that which is apparently set for him by Parliament. It will be a bad day for every one when the profession contains only practitioners who do no more than pay visits and prescribe drugs.

SANATORIUM BENEFIT

The reference above to preventive medical treatment leads me to the part of the act which deals with sanatorium benefit for tubercular cases. The provision of sanatoria for the treatment of tuberculosis deserves and has received the approbation of the medical profession, as has also the financial plan for its carrying out; the extension of sanatorium treatment to the dependents of the insured, when it can be done, is also worthy of praise. It must, however, be borne in mind that sanatoria will not prevent tuberculosis, and that such institutions can only be expected to benefit early cases of the disease. To eradicate tuberculosis requires an alteration of the homes of the poor and other things not to be had at present; further, the act will have to be very carefully administered if the sanatoria are not to be filled with hopelessly advanced cases to the exclusion of the early and more hopeful ones. Again, sanatorium treatment may not be the last word in tuberculosis, and it may be questioned whether it is wise to sink so much State money in it; perhaps, however, the phrase "other institutions or otherwise" may be taken as the safeguard here.

MATERNITY BENEFIT

The provision of maternity benefit is what one may call the obstetric part of the act. This consists of a sum of thirty shillings. The expectant mother is to have power to decide whether she will be attended by a duly qualified medical practitioner or by a duly certified midwife, and she may select the practitioner or midwife whom she prefers. If she selects a midwife, and a practitioner has to be called in at a later stage on account of some abnormality in the labor, "the prescribed fee shall, subject to regulations made by the Insurance Commissioners, be recoverable as part of the maternity benefit." This is evidently an attempt to repair a serious defect in the Midwives Act of 1902, for in that legislative measure there was no arrangement made for meeting the cost of professional advice. There must remain a good deal of uncertainty regarding the working of the maternity benefit clauses of the act until they have actually come into operation; their effect, for instance, upon the maternity hospitals and their funds can hardly be judged for a time, but there will doubtless be a tendency to suspend schemes for extending or remodelling such institutions until it is seen how far the act is going to injure, or, it may be, benefit them. In this connection the training of midwives must also be borne in mind.

I have attempted to sketch the chief parts of this large, one may almost say gigantic, legislative experiment, restricting myself to its medical clauses, although these are, let us remember, the very heart and marrow of it. At the present moment (April, 1912) there is an apparent lull in the progress of events, for the administrative bodies are being set up, and it will be some months before it can be seen what attitude the profession is going to assume, and how the amended bill (now the act) has served to meet the profession's difficulties. The act, it has been arranged, may come into partial operation on July 15, 1912, and insured persons may begin to receive benefits six months later; but there is provision for postponement until January 1, 1913. The lull is only apparent, for many arrangements are no doubt being made to deal with the complexities involved in the working of the act. In a few months the medical profession will have to decide whether it can with any degree of heartiness agree to try to enter into the scheme, or whether it will, so to say, go out on strike. In this connection it may perhaps be

worth while to repeat what has already been said more than once in Parliament and outside of it, *viz.*, that a doctors' strike does not mean that a single sick person in the United Kingdom will be unable to obtain attendance in his or her illness; the doctors will continue to do their work and attend to their patients, but they will not do so as part of the machinery of the act.

ANTI-PROFESSIONAL BIAS

It may not be inappropriate if I touch, in conclusion, upon a somewhat sinister aspect of recent legislation in so far as medical matters have been dealt with in it. I refer to the very slightly veiled antagonism to the profession which exists apparently in many quarters. This was seen in the Notification of Births Act, by which a medical man may be fined for not notifying a birth, whilst he receives no remuneration for so doing; it was seen in the Midwives Act, in which a midwife is commanded to call in a duly qualified medical practitioner in abnormal cases of labor, but in which no provision is made for the paying of the practitioner so called in; it was seen in the so-called conscientious objector's clause in the Vaccination Act, and in the general way in which other medical subjects have been handled; and it has been very evident, both inside and outside Parliament, in connection with the National Insurance Act of 1911. The doctors "were out for fees," they were demanding their pound of flesh, they were going to strike; these were some of the accusations and jeers which were hurled at them when they ventured adversely to criticize the details of an act which they would be required to carry out. It was said that the act gave the medical men too much power, and that it put the public under a professional despotism of the most intolerable kind. It was affirmed that the medical criticism of the bill was a piece of party politics. As if there were no doctors belonging to the Liberal side in such matters!

THE FUTURE

The medical profession must look all these facts in the face. It must likewise recognize that it possesses very little political power: few medical men can afford to leave their work to contest elections and sit in Parliament; and the combined vote of the profession outside of Parliament consists of only a small number of thousands,

constituting a negligible quantity in the eyes of the party politician. Its power lies in no such direction. It must now, of course, and without grumbling, look carefully at the act, for it is the law of the land; it must be ready to tender advice, when called upon, as to the best methods of making it a useful and beneficent measure; it will be well within its rights if it endeavor in every legitimate manner and by every fair method to safeguard its position under the act and to obtain a fair remuneration for the work which it and it alone can do. If it turn out that the conditions are quite unworkable or that the Commissioners are deaf to common-sense suggestions and advice, the failure will then be put to the account of the proper persons. In the meantime, and indeed for all time, there is nothing for it but that medical men and medical women shall go on quietly doing their duty, and shall continue to deserve, even if they do not receive, the respect and affection of those among whom they labor and for whom they sometimes risk their lives. Let us remember Ruskin's kindly appreciation and counsel in *The Crown of Wild Olive:* "Doctors like fees, no doubt,—ought to like them; yet if they are brave and well-educated, the entire object of their lives is not fees. They, on the whole, desire to cure the sick; and—if they are good doctors, and the choice were fairly put to them—would rather cure their patient, and lose their fee, than kill him, and get it. . . . . their work is first, their fee second—very important always, but still *second.*"

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